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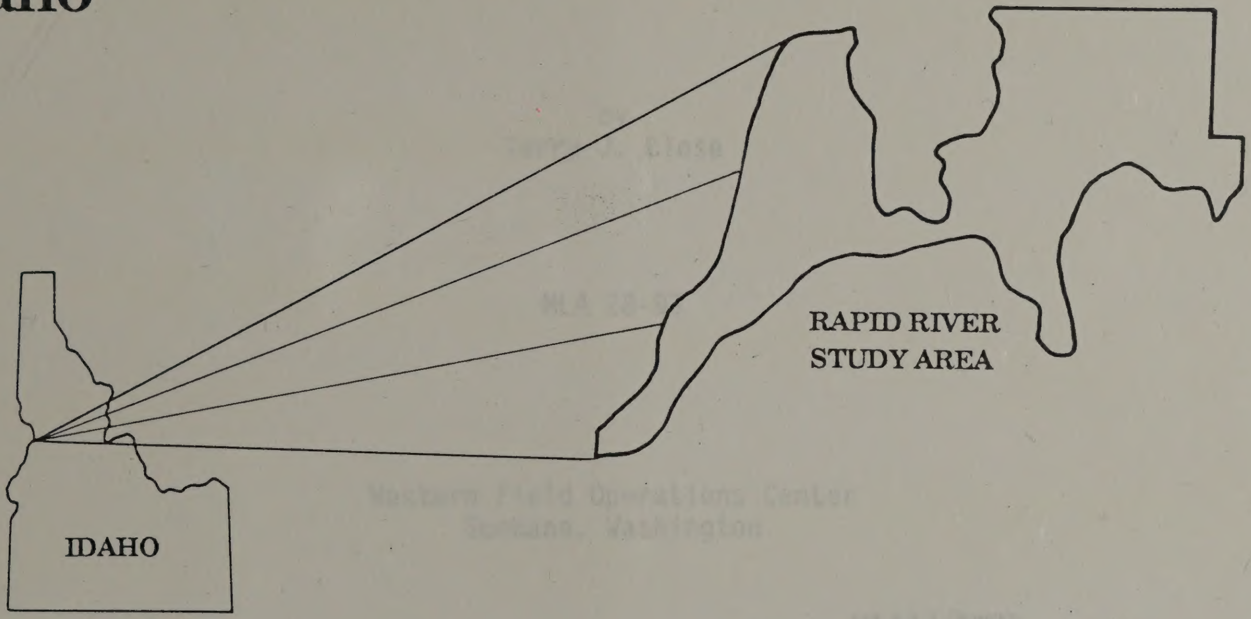
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MINERAL RESOURCES OF THE RAPID RIVER STUDY AREA, ADAMS COUNTY, IDAHO

by
Terry J. Close

MLA 28-93

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Bruce Babbitt, Secretary

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Hermann Enzer, Acting Director

PREFACE

The Wilderness Act (Public Law 88-577, September 7, 1964) and related acts require the U.S. Bureau of Mines to investigate certain Federal lands ". . . to determine the mineral values, if any, that may be present . . ." Results must be made available to the public and be submitted to the President and the Congress. This report presents the results of a U.S. Bureau of Mines mineral investigation of the Rapid River roadless area, Adams County, west-central Idaho.

This open-file report contains data gathered and interpreted by personnel of the Bureau of Mines, Western Field Operations Center, Branch of Resource Evaluation, East 360 Third Avenue, Spokane, WA 99202. The report has not been edited or reviewed for conformity with Bureau of Mines editorial standards.

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ABBREVIATIONS AND CONVERSIONS USED IN THIS REPORT

In conformance with the Omnibus Trade and Competitiveness Act of 1988 and Executive order 12770, dated July 25, 1991, measurements made during this study have been converted to the metric system. Conversions have been done using Federal Standard No. 376A, May 5th, 1982--preferred metric units for general use by the Federal Government, General Services Administration. Some information in the text and appendix, copied from other sources, has been left in its original measurement system. For the convenience of the reader, significant precious-metals concentrations are shown in both metric and english units.

cm	centimeter (cm x 0.3937 = inch).
m^3	cubic meter (m^3 x 1.3079 = cubic yard).
°	degree.
g	gram (g x 0.0322 = troy ounce).
g/t (tonne)	gram per metric ton (g/t x 0.029 = troy ounce per short ton).
ha	hectare (ha x 2.471 = acre).
kg	kilogram (kg x 2.205 = pound).
kg/m^3	kilogram per cubic meter (kg/m^3 x 0.593 = pounds per cubic yard).
km	kilometer (km x 0.6214 = mile).
lat	latitude.
long	longitude.
m	meter (m x 3.28 = feet).
t	metric ton (tonne) (t x 0.9072 = short ton).
t/d	metric ton per day (t/d x 0.9072 = short ton per day).
′	minute.
ppb	part per billion.
ppm	part per million (0.0001 percent).
″	second.
km^2	square kilometer (km^2 x 0.291 = square mile).
oz	troy ounce (oz x 31.103 = grams).
oz/ton	troy ounce per ton (oz/ton x 34.285 = gram per metric ton).

SUMMARY

The highly-mineralized 43,700-ha Rapid River study area, on the southeast side of Hells Canyon Wilderness and west of the village of Cuprum, in Adams County, western-Idaho, was investigated in 1992 by the USBM (U.S. Bureau of Mines) in conjunction with its Idaho Land Assessment Program. The 1992 study updated data gathered during the USBM's 1974-76 Wilderness investigation.

The studies consisted of the evaluation of 61 mineralized sites and the estimations of tonnages, grades, and minability of these sites. Most of the sites studied are in two mineralized locales--Windy Ridge and Jackley Mountain. A few isolated sites, peripheral to the two locales, were also examined. The 61 sites contained more than 340 mine and prospect workings, including about 10,300 meters (34,000 feet) of underground workings, plus 134 drill holes.

Since 1870 at least 2,000 lode, placer, and millsite claims have been located in the Rapid River study area; 88 of the claims were patented. In 1992, at least 766 unpatented claims were being held.

Between 1883 and 1968, recorded production of gold, silver, copper, lead, zinc, and tungsten from 12 mines in the study area had a total value of at least $2 million, at historic prices. The majority of this production was from tactite-type deposits at the Peacock and South Peacock, with small amounts of these metals also coming from tactites at the Lockwood, Tussel, White Monument, and Victory tungsten mines, all in the vicinity of Windy Ridge. The remaining production came mostly from volcanogenic deposits at the Azurite, Crackerjack, Lime Peak, and River Queen mines, in the vicinity of Windy Ridge, and from fissure veins at the Maid of Erin and Summit mines near Jackley Mountain. Production has also been recorded for another 11 mines within 2 km of the study area.

The study area has large, possibly minable, copper, zinc, silver, and gold resources, along with extensive limestone and sand and gravel deposits. Lode resources at five sites within the study area, in order of decreasing importance--Red Ledge prospect, Peacock mine, South Peacock mine, Maid of Erin mine, and Summit mine, are estimated to total about 25 million t (22.7 million short tons) containing, in order of historic importance--copper, silver, gold, and zinc. Another 34 sites are likely to have resources. At two nonmetallic sites are extensive deposits of limestone; at another is a large sand and gravel deposit. There is no evidence of petroleum or other energy resources.

The lode resources are concentrated in three deposit types--1) volcanogenic (kuroko-type) deposits containing gold, zinc, copper, and silver; 2) contact replacement zones (tactites) containing copper and silver; and 3) fissure veins containing gold.

Comprising the nonmetallic mineral resources of the study area are extensive deposits of limestone along the Snake and Rapid Rivers, and an

extensive sand and gravel deposit along Rapid River. The limestone is pure, but too remote from potential markets to be competitive. It could be utilized in the event that nearby construction occurs. The sand and gravel deposits lie along Rapid River, designated a Wild River, and so their development is unlikely.

INTRODUCTION

This report describes the USBM investigation of the mineral resources of the Rapid River study area; made in conjunction with its Idaho Land Assessment Program. The Bureau has been conducting mineral surveys of roadless lands in Idaho proposed in the past for wilderness designation. USBM personnel examine individual mineralized sites to evaluate their mineral and energy resources. The results of these examinations are used in the determinations of the suitability of the areas studied for inclusion into the National Wilderness Preservation System. Although the immediate goal of this and other USBM mineral surveys is to provide data for the President, Congress, government agencies, and the public for land-use decisions, the long-term objective is to ensure the Nation an adequate and dependable supply of minerals at a reasonable cost. All USBM data are on file at the Western Field Operations Center, Spokane, Washington.

Lands included in the 1992 study of the Rapid River area had been investigated previously by the USBM, from 1974 to 1976, in conjunction with studies mandated by: 1) the Wilderness Act (Public Law 88-577, September 7, 1964), 2) Public Law 94-199, which created the Hells Canyon National Recreation area, Hells Canyon Wilderness, and Snake and Rapid Wild and Scenic Rivers; and 3) the U.S. Forest Service Roadless Area Review and Evaluation (RARE II), including the Rapid River study area.

The study area is adjacent to the southeastern part of the Hells Canyon Wilderness and National Recreation Area. The study area includes two RARE II areas (nos. 1-922 and 4-922) classified "Non-Wilderness Recommended" by the Forest Service (January 1979) as a result of their RARE II inventory.

Geographic Setting

The Rapid River study area, covering about 43,700 ha, lies to the west of the village of Cuprum in Adams County, western, Idaho (fig. 1). It is comprised of Payette National Forest roadless lands contained in the geographic block bounded on the northeastern corner by lat. 45°20′00" N. and long. 116°15′00" W., and on the southwestern corner by lat. 45°00′00" N. and long. 116°50′00" W. (fig. 2 and tables 1 and 2). The area can be reached by improved roads from U.S. Highway 95; along the Little Salmon River.

The study area includes parts of the Seven Devils and Mountain View unorganized mining districts. The part of the Seven Devils district

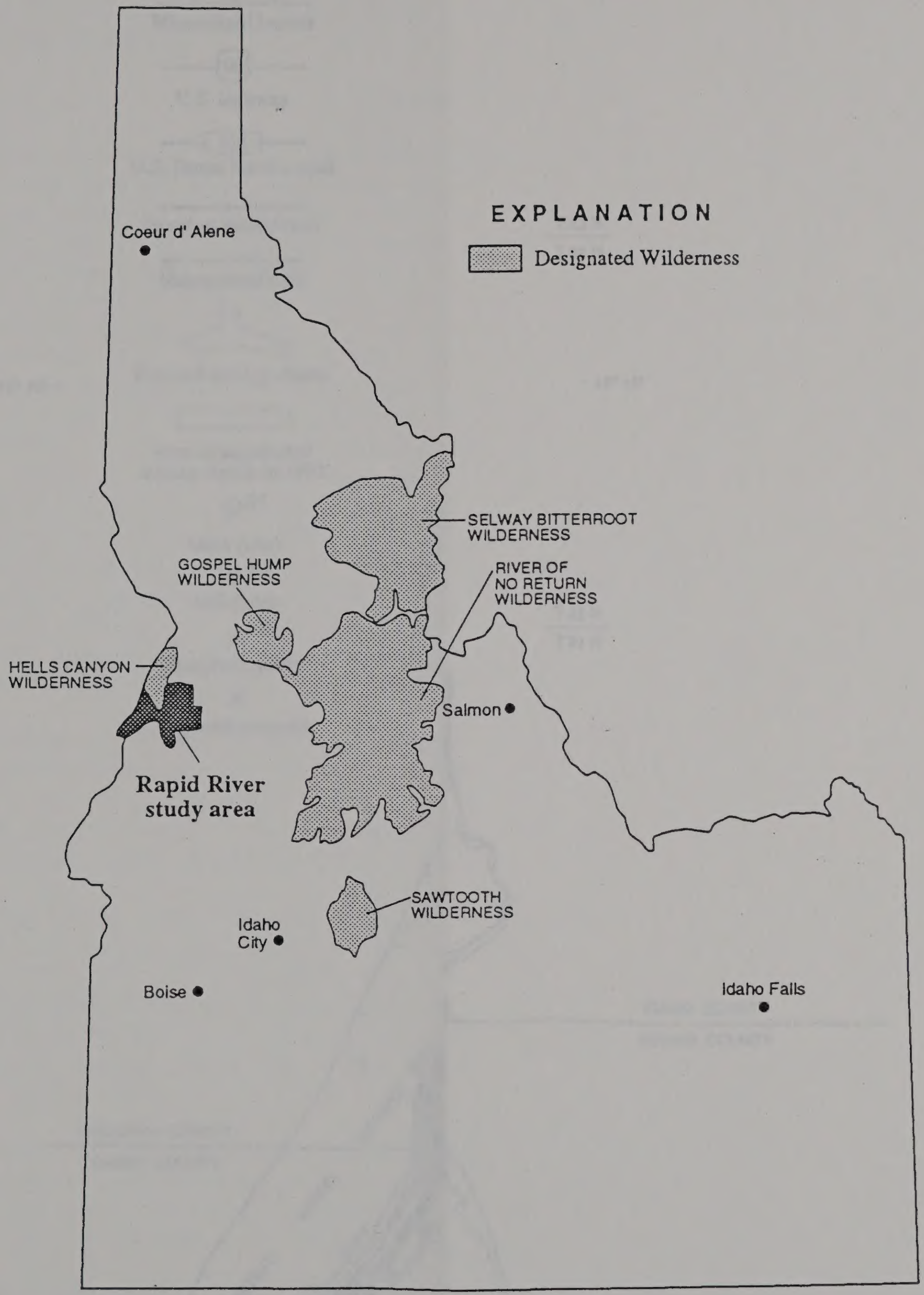
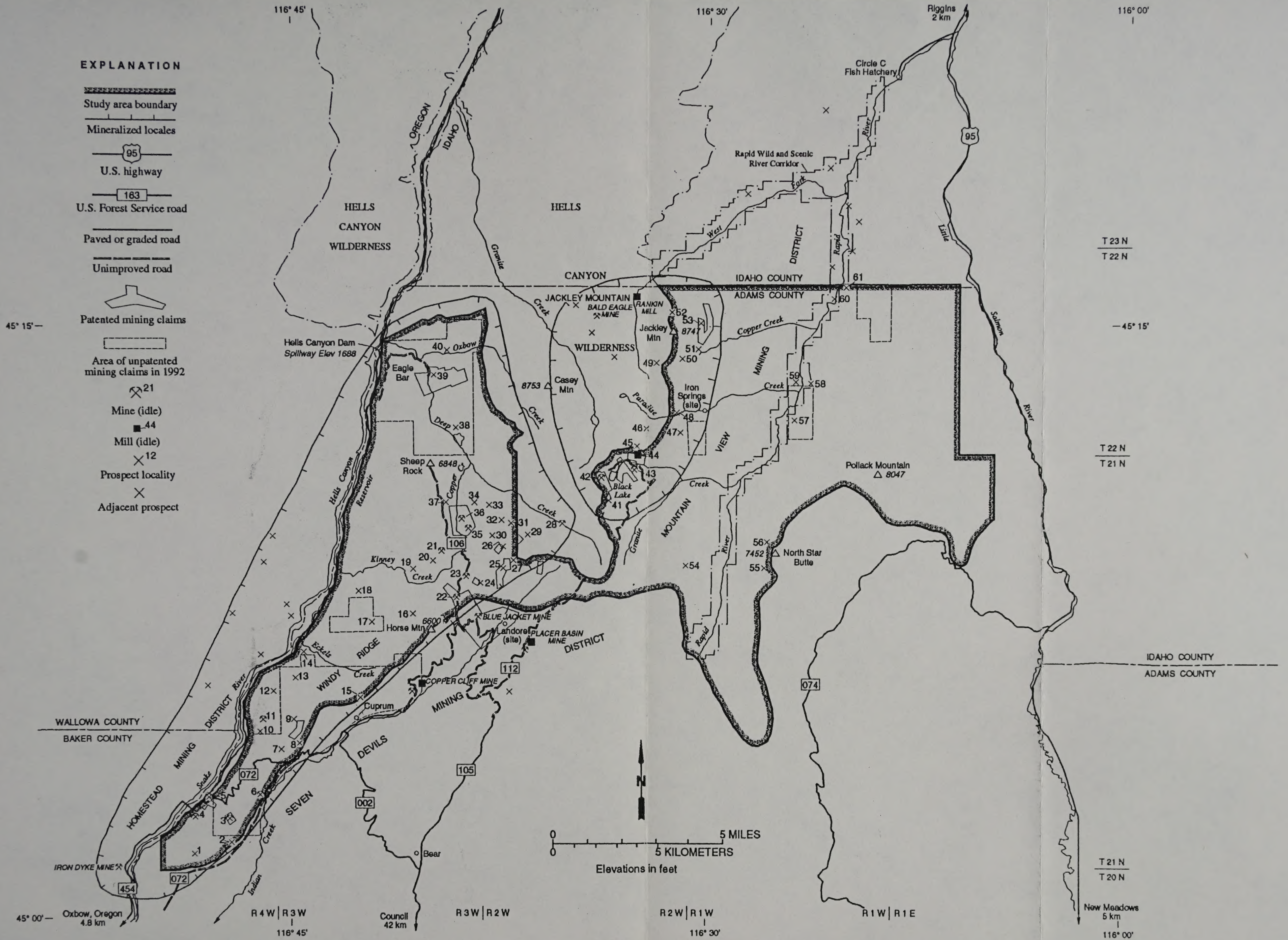

EXPLANATION
▨ Designated Wilderness
Coeur d' Alene
SELWAY BITTERROOT WILDERNESS
GOSPEL HUMP WILDERNESS
RIVER OF NO RETURN WILDERNESS
HELLS CANYON WILDERNESS
Salmon
Rapid River study area
SAWTOOTH WILDERNESS
Idaho City
Boise
Idaho Falls

Figure 1. - Location of the Rapid River study area.


EXPLANATION
Study area boundary
Mineralized locales
95
U.S. highway
163
U.S. Forest Service road
Paved or graded road
Unimproved road
Patented mining claims
Area of unpatented mining claims in 1992
21
Mine (idle)
44
Mill (idle)
12
Prospect locality
Adjacent prospect
116° 45'
116° 30'
116° 00'
45° 15'
45° 00'
Riggins 2 km
Circle C Fish Hatchery
Rapid Wild and Scenic River Corridor
HELLS CANYON WILDERNESS
HELLS CANYON WILDERNESS
OREGON
IDAHO
IDAHO COUNTY
ADAMS COUNTY
JACKLEY MOUNTAIN
BALD EAGLE MINE
RANKIN MILL
Jackley Mtn
8747
Copper Creek
WEST FORK RAPID RIVER
DISTRICT
MINING
VIEW
MOUNTAIN
Hells Canyon Dam Spillway Elev 1688
Oxbow
Eagle Bar
Deep
8753
Casey Mtn
Iron Springs (site)
Paradise
Granite Creek
Sheep Rock
6848
Copper
Black Lake
Creek
Kinney Creek
Horse Mtn
6600
BLUE JACKET MINE
Landore (site)
PLACER BASIN MINE
DISTRICT
WINDY RIDGE
Eckels Creek
COPPER CLIFF MINE
Cuprum
MINING
DEVILS
SEVEN
Indian Creek
Snake River
HOMESTEAD
MINING
DISTRICT
Hells Canyon Reservoir
WALLOWA COUNTY
BAKER COUNTY
IRON DYKE MINE
Oxbow, Oregon 4.8 km
Council 42 km
Bear
Pollack Mountain
8047
North Star Butte
7452
Rapid
Little Salmon River
Rapid River
T 23 N
T 22 N
T 21 N
T 20 N
R 4 W | R 3 W
R 3 W | R 2 W
R 2 W | R 1 W
R 1 W | R 1 E
New Meadows 5 km
IDAHO COUNTY
ADAMS COUNTY
072
454
002
105
106
112
074
95
N
0
5 MILES
0
5 KILOMETERS
Elevations in feet
1
2
3
4
5
6
7
8
9
10
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60
61

Figure 2. - Mineralized sites within and adjacent to the Rapid River study area.

within the study area, the part west of the Snake River-Indian Creek divide, is described under Windy Ridge in this report. The Mountain View district, in the Rapid River drainage, is described here under Jackley Mountain.

Previous Studies

Between 1904 and 1937, Idaho Mine Inspectors published sketchy descriptions of some important mineralized sites in the Seven Devils mining district; including a few in the Windy Ridge part of the district (Bell, 1904, 1905, and 1916; and Campbell, 1937). Livingston and Laney (1920) described, in more detail, some sites in the district. Cook (1954) briefly described some of the major mineral deposits. Hamilton (1963) described the geology of the Riggins region, including the Rapid River drainage. Vallier (1974) described the geology of the Snake River Canyon. Savage (1969) described the carbonate rocks in the vicinity of Rapid River. Vallier and Brooks (1970) described the geology and deposits of the adjacent Homestead area, Oregon. Morganti (1972) described the geology and ore deposits of the southern part of Windy Ridge. Between 1978 and 1986, the U.S. Geological Survey, in cooperation with the USBM, published descriptions of the geology and mineral resource potential of the Hells Canyon Wilderness and vicinity (Gualtieri and Simmons, 1978; Simmons and others; 1983; and Simmons and others, 1986). In 1979, the Idaho Geologic Survey compiled a geologic map of the 1:250,000-scale Grangeville Quadrangle, containing the Rapid River study area (Gaston and Bennett, 1979).

The USBM conducted a mineral investigation of the Hells Canyon Wilderness and nearby roadless lands, including the Rapid River study area, between 1974-1976 (Close and others 1976 and 1982). During this work, much of which was concentrated in the Rapid River study area, USBM personnel spent approximately 4 man-years in the field.

Mining claim data for the 1974-76 study were obtained from the records of Adams County and the U.S. Bureau of Land Management. Mineral resource data for a number of sites were obtained from published and unpublished reports by the Idaho Bureau of Mines and Geology, U.S. Bureau of Mines, U.S. Geological Survey, U.S. Forest Service, and various mining companies. Mining claim owners provided historical and geological data.

During the earlier study, most mineral sites in the Rapid River study area were sampled and, if warranted, mapped. Examined were more than 240 prospect pits and trenches, 134 drill holes, and 100 underground workings with combined total lengths of about 10,300 m.

During the study, a total of 487 rock (lode) and 26 placer samples were taken. The rock samples were checked for radioactive and fluorescent minerals and then fire assayed to determine gold and silver concentrations. Concentrations of other metallic constituents were determined by atomic absorption, colorimetric, or spectrographic

TABLE 1.--Alphabetical index of mineralized sites within and adjacent to the Rapid River study area.

[Mineralized sites shown on figure 2; significant sites are underlined.]

Name	(fig. 2, no.)
Allison Creek prospect (copper)	17
Antz Creek mine (copper, gold, silver)	4
Azurite mine (silver, copper, lead, zinc, gold)	3
Black Leopard prospect (gold, silver)	57
California prospect (copper, gold, silver)	25
Chieftain prospect (copper, silver, gold)	26
Cliff prospect (copper, gold, silver)	40
Crackerjack mine (silver, copper, gold)	6
Curren Mountain prospect (gold, silver)	47
Devil's Hollow prospect (copper, silver, gold)	31
Dry Gulch prospect (copper, silver, gold)	18
East Allison Gulch prospect (copper, gold, silver)	16
Emily prospect (copper, silver, gold)	24
Eureka prospect (copper, silver, gold)	8
Golden Star prospect (copper, gold, silver)	10
Haily Ridge prospect (copper, gold)	37
Heady prospect (copper, silver)	38
Hibble Gulch prospect (copper, gold, silver)	13
High Five Placer; Maid of Erin and Summit millsites (gold)	44
Holbrook Saddle prospect (gold, silver, copper)	50
Indian Springs prospect (gold)	55
Iron Springs prospect (gold, copper)	48
Jackley Ridge prospect (copper, silver, gold)	52
Lime Peak mine (copper, silver, gold)	11
Lockwood mine (copper, silver, gold, tungsten, molybdenum)	22
Lower Devil's Hollow prospect (copper, gold)	33
Lyles Saddle prospect (silver, copper, gold, lead, mercury)	15
Maid of Erin mine (gold, silver)	43
Mayflower prospect (gold, silver)	53
Middle Mountain prospect (gold, silver, copper)	49
Nix prospect (copper, silver)	7
North Lime Peak prospect (copper, gold, silver)	12
North Star Butte prospect (gold)	56
Pactolian Gulch prospect (copper, gold, silver)	46
Paducah prospect (gold)	9
Panama Pacific (Victoria) prospect (copper, gold, silver)	34
Paradise Cabin prospect (gold)	59
Peacock mine (copper, silver, gold)	36
Pepperbox no. 2 prospect (copper, gold, silver)	29
Rapid River limestone	61
Rapid River placers (sand, gravel, gold)	60
Red Ledge prospect (gold, zinc, copper, silver)	39
Ritchie Gulch adit (silver)	30
Ritchie Gulch prospect (copper, gold, silver)	32
River Queen mine (copper, silver, gold)	5
Rock Lake prospect (gold)	41
Satan Lake prospect (gold, silver, copper)	45
Snake River limestone	14
South Peacock mine (copper, silver)	35
Summit mine (gold, silver)	42
Terry prospect (copper, gold, silver)	1
Trail Creek prospect (copper, gold)	58
Tussel adit (copper, silver, gold)	20
Tussel mine (copper, silver, gold)	21
Tussel shaft (copper, silver gold)	19
Twin Lakes prospect (gold)	54
Victory tungsten mine	28
Virginus prospect (gold, silver)	27
White Monument mine (copper, silver, gold)	23
White Rose prospect (gold, silver, copper)	51
Windy prospect (copper, gold, silver)	2

TABLE 2.--Numerical index of mineralized sites within and adjacent to the Rapid River study area.

[Mineralized sites shown on figure 2; significant sites are underlined.]

(fig. 2, no.)	Name
1.	Terry prospect (copper, gold, silver)
2.	Windy prospect (copper, gold, silver)
3.	Azurite mine (silver, copper, lead, zinc, gold)
4.	Antz Creek mine (copper, silver, gold)
5.	River Queen mine (copper, silver, gold)
6.	Crackerjack mine (silver, copper, gold)
7.	Nix prospect (copper, silver)
8.	Eureka prospect (copper, silver, gold)
9.	Paducah prospect (gold)
10.	Golden Star prospect (copper, gold, silver)
11.	Lime Peak mine (copper, silver, gold)
12.	North Lime Peak prospect (copper, gold, silver)
13.	Hibble Gulch prospect (copper, gold, silver)
14.	Snake River limestone
15.	Lyles Saddle prospect (silver, copper, gold, lead, mercury)
16.	East Allison Gulch prospect (copper, gold, silver)
17.	Allison Creek prospect (copper)
18.	Dry Gulch prospect (copper, silver, gold)
19.	Tussel shaft (copper, silver, gold)
20.	Tussel adit (copper, silver, gold)
21.	Tussel mine (copper, silver, gold)
22.	Lockwood mine (copper, silver, gold, tungsten, molybdenum)
23.	White Monument mine (copper, silver, gold)
24.	Emily prospect (copper, silver, gold)
25.	California prospect (copper, gold, silver)
26.	Chieftain prospect (copper, silver, gold)
27.	Virginus prospect (gold, silver)
28.	Victory tungsten mine
29.	Pepperbox no. 2 prospect (copper, gold, silver)
30.	Ritchie Gulch adit (silver)
31.	Devil's Hollow prospect (copper, silver, gold)
32.	Ritchie Gulch prospect (copper, gold, silver)
33.	Lower Devil's Hollow prospect (copper, gold)
34.	Panama Pacific (Victoria) prospect (copper, gold, silver)
35.	South Peacock mine (copper, silver)
36.	Peacock mine (copper, silver, gold)
37.	Haily Ridge prospect (copper, gold)
38.	Heady prospect (copper, silver)
39.	Red Ledge prospect (gold, zinc, copper, silver)
40.	Cliff prospect (copper, gold, silver)
41.	Rock Lake prospect (gold)
42.	Summit mine (gold, silver)
43.	Maid of Erin mine (gold, silver)
44.	High Five Placer; Maid of Erin and Summit millsites (gold)
45.	Satan Lake prospect (gold, silver, copper)
46.	Pactolian Gulch prospect (copper, gold, silver)
47.	Curren Mountain prospect (gold, silver)
48.	Iron Springs prospect (gold, copper)
49.	Middle Mountain prospect (gold, silver, copper)
50.	Holbrook Saddle prospect (gold, silver, copper)
51.	White Rose prospect (gold, silver, copper)
52.	Jackley Ridge prospect (copper, silver, gold)
53.	Mayflower prospect (gold, silver)
54.	Twin Lakes prospect (gold)
55.	Indian Springs prospect (gold)
56.	North Star Butte prospect (gold)
57.	Black Leopard prospect (gold, silver)
58.	Trail Creek prospect (copper, gold)
59.	Paradise Cabin prospect (gold)
60.	Rapid River placers (sand, gravel, gold)
61.	Rapid River limestone

analyses. At least one sample from each mineralized structure was analyzed by semiquantitative spectrographic methods as a guide to additional analyses. The 1974-76 spectrographic analyses are not listed in this report.

In the field, the placer samples were concentrated by panning. The pan concentrates were further processed on a laboratory vibrating table. Any visible gold was recovered by hand or by mercury amalgamation.

Most of the tonnage and grade estimates listed in this report resulted from the 1974-76 work. These tonnage estimates were calculated by multiplying the average sampled thicknesses of the mineralized structures by their measured or inferred lengths. The products were then multiplied by the dip lengths, and the resulting volumes divided by the weight factor 12 the number of cubic feet of material per short ton (0.374 m^3 per metric ton). The results were converted to metric units for this report. In most cases, depths of the mineralized structures could not be measured, and so were assumed to equal one-half the lengths. Grades (average metal content) are weighted averages of samples chipped from across the mineralized structures.

Present Study

The USBM conducted the prefield and field phases of the current Rapid River study in 1992. During the prefield studies available sources were perused for minerals data for the years between the previous and present studies--1976 and 1992; few were found. In addition, the Idaho Geologic Survey (Mitchell, 1993) compiled geologic and mineral resource information for the study.

During the 1992 field work, as many mineralized sites examined during 1974-76 were revisited and sampled as time allowed. Resampling was done to learn what modern assaying techniques (with lower detection limits), developed since 1976, could reveal about the mineralogy of the sites. During 1992, 31 rock samples were taken. These samples were analyzed for Au (gold), Ag (silver), As (arsenic), Bi (bismuth), Cu (copper), Hg (mercury), Mn (manganese), Mo (molybdenum), Pb (lead), Sb (antimony), W (tungsten), and Zn (zinc) at a IGAL, Inc., Cheney, Wash. These data are listed in appendix C.

ACKNOWLEDGMENTS

The aid and cooperation of local residents, claim owners, and Forest Service personnel helped greatly. We particularly appreciate the assistance and information received from George Robbins, Ralph Page, Agnew Mines Company, Canyon View Mining Company, Butler Ore Company, Sunshine Mining Company, Texasgulf Incorporated, and Alta Gold Corporation. USBM personnel Francis E. Federspiel and Andrew M. Leszcykowski, assisted by Eric Zahl, Michael McCulla, Donald Smith, Robin McCulloch, Philip Barrett, William Hudson, Thomas Mattern, Andrew Berg, Karen Sweetman, Jerry Olsen, Dennis Finn, James Rigby, Douglas Harby, Jeffery Wilson, and Ernest Tuchek aided in the 1974-76 studies.

Clayton Rumsey assisted during the 1992 field studies.

GEOLOGIC SETTING

The Rapid River study area lies along the junction of the Columbia Plateau and Northern Rocky Mountains physiographic- and geologic-provinces (Simmons and others, 1983, p. 5). The area is also along the eastern-most bulge of the Columbia Arc (Taubeneck, 1966), just west of the Idaho batholith.

The following summary description of the study area geology is adapted from Vallier (1974), Simmons and others (1983), Gaston and Bennett (1979), and Mitchell (1993).

The Rapid River study area is underlain by two geologic assemblages. The more extensive assemblage, underlying the western two-thirds of the area, consists mainly of island arc- and intrusive-rocks. The second assemblage, underlying the eastern-third of the area and contained in a thrust-fault plate lying east of Rapid River, is comprised of highly metamorphosed rocks. The western rocks are highly mineralized; eastern rocks are not.

The western- and eastern-rock assemblages are overlain by unmineralized basalt flows of Tertiary age, and also by cataclastic rocks and gravel deposits, which locally underlie the basalt flows, and by surficial deposits (moraines, terrace gravels, colluvium, and alluvium) all of Quaternary age. The plateau basalt covered the older rocks, and subsequent uplift and erosion created the present topography.

Rocks of three principal units comprise the assemblage underlying the western two-thirds of the Rapid River study area. From youngest to oldest these units consist of: 1) plutons and related dikes and sills, mainly of Triassic through Cretaceous age; 2) Martin Bridge formation limestone and dolomite, of Triassic-age; and 3) volcanic and volcaniclastic rocks (greenstone) of Permian through Triassic ages.

The Permian- through Triassic-age volcanic and volcaniclastic rocks, also called Seven Devils Group, are of marine origin and are part of an island arc assemblage--faulted, folded, intruded by plutons (mainly granodiorite), and deeply eroded. These rocks correlate with the highly-mineralized Clover Creek Greenstone in the Wallowa Mountains of northeastern Oregon.

The island-arc unit containing the study area's principal metallic mineral resources is the Wild Sheep Creek formation. It consists of metamorphosed-flows and -volcaniclastic rocks, and limestone. The unit containing the study area's principal nonmetallic mineral resources is the extensive Martin Bridge formation. It consists of limestone and dolomite.

Rocks of two principal sequences underlie the eastern-third of the study area. From youngest to oldest these are comprised of: 1) highly

metamorphosed sedimentary rocks of the Lucile formation (phyllite), along with mylonite and limestone; all Mesozoic-age; and 2) highly metamorphosed units; possibly Paleozoic age. The rocks contain a few, poorly-exposed metallic mineral sites. The principal mineral resource, limestone, is contained in a sheared, unnamed limestone unit.

Structural trends in the Rapid River study area are mainly northeast-trending. Tectonic stresses caused faulting in the brittle volcanic rocks and folding in the more plastic limestone and shale.

Types of Mineralized Sites

The metallic mineral resources of the Rapid River study area are contained in three deposit types; listed in order of historic (production) importance--1) contact replacement zones (tactites); 2) volcanogenic (kuroko-type) occurrences and; 3) fissure-veins. The tactites have been the most productive, but recent exploration was directed toward the larger volcanogenic occurrences. Siliceous fissure-veins were also productive in the past, and could be again.

Tactites

The more important tactite occurrences in the study area are in the northern part of Windy Ridge; between the Lockwood mine and Haily Ridge prospect (fig. 2, nos. 22 and 37). The tactites are along a northwest-trending, discontinuous zone of limestone intruded by granodiorite. Metals-bearing solutions replaced the limestone, during the intrusion of granodiorite, with garnet, epidote, quartz, malachite, pyrite, chalcopyrite, bornite, covellite, chalcocite, and native copper. The tactites were productive and could be again. Drilling indicates that the intruding granodiorite could contain undiscovered resources.

Volcanogenic Occurrences

Volcanogenic occurrences, probably kuroko-type, occur in island-arc-deposited rocks extending northerly from the Antz Creek mine to the Red Ledge prospect (fig. 2, nos. 4 and 39). The volcanogenic occurrences are in and around pyrite-bearing rhyolite intrusions.

There are three varieties of volcanogenic-type mineral occurrences in the study area--1) lenses of andesite, rhyolite, and quartz containing chalcopyrite, pyrite, chalcocite, sphalerite, and galena; 2) quartz fissure-veins and andesitic wallrock containing tetrahedrite, bornite, pyrite, sphalerite, and galena; and (3) disseminations of pyrite, chalcopyrite, sphalerite, bornite, and chalcocite in and around stockworks of quartz veinlets in brecciated rhyolite and andesite.

The formation of the volcanogenic deposits probably accompanied volcanic activity in an island arc geologic environment. Quartz and sulfides were concentrated during volcanic activity and deposited in rhyolitic source rocks, which formed volcanic necks, and in overlapping flows and pyroclastic rocks. The deposits were associated with black smokers (sea

floor hot springs) and were localized in certain rock layers; generally in depressions in the ancient sea floor.

The rhyolite intrusion at the Red Ledge prospect is probably a volcanic neck. The sulfide-bearing lenses and disseminations in and around that intrusion also are of volcanic origin. Lenses and veins deposited from the Red Ledge and other volcanic centers occur as far north as Rapid River.

The only volcanogenic-disseminated deposit so far outlined in any detail is at the Red Ledge prospect. Geophysical studies and drilling, however, indicate that disseminated sulfides are also associated with the lenses and veins at the Nix prospect (fig. 2, no. 7). Rhyolitic intrusions, that may also contain volcanogenic deposits, crop out in the vicinities of Oxbow and Deep Creeks. Copper stain occurs along fractures in overlapping andesitic flows, and within these rhyolitic intrusions. The intrusions are coated by jarosite and hematite, and contain disseminated pyrite. Drilling and underground development at the Red Ledge prospect and Iron Dyke mine revealed copper, zinc, silver, and gold resources. Exploration of the other intrusions in the study area may disclose additional mineral resources.

Fissure Veins

Study area fissure veins generally are associated with intrusive contact zones. Scattered, the most important ones are near Jackley Mountain. Veins there were formed by circulation of metal-bearing solutions during the emplacement of dioritic rocks. The veins were controlled by fractures, in contrast to the volcanogenic deposits which are controlled by bedding. Most are poorly exposed.

MINING HISTORY

Early mining in the Rapid River study area centered in the Windy Ridge local in the Seven Devils district. Residual placer deposits there were claimed in the 1870's; underlying tactites were discovered in the 1880's. Tactite deposits at the South Peacock and Peacock mines (fig. 2, nos. 35 and 36) were developed first.

Between 1883 and 1906, the principal period of mine development, rail lines were surveyed to mines on Windy Ridge (Glover, 1924). The proposed rail lines stimulated exploration and development work at a number of mineral prospects. Construction of a wagon road from Cuprum to West Fork Rapid River increased activity in the vicinity of Jackley Mountain. Work on most mineral prospects declined when the rail lines were abandoned in 1906.

Only sporadic mining took place in the Seven Devils district and Windy Ridge between 1928 and the discovery of the Copper Cliff mine in the late 1960's. Most of the small amount of ore produced during this period came from tactite deposits, although a small amount was also mined from veins and lenses. The complex oxide-, carbonate- and floor but sulfides were localized in certain rock layers, generally in depressions in the ancient sea floor.

The rhyolite intrusion at the Red Ledge prospect is probably a volcanic neck. The gold-bearing lenses and disseminations in and around this intrusion also are of volcanic origin. Lenses and veins deposited from the Red Ledge and other volcanic centers occur as far north as Rapid River.

The only volcanogenic-disseminated deposit so far outlined in any detail is at the Red Ledge prospect. Geophysical studies and drilling, however, indicate that disseminated sulfides are also associated with the lenses and veins at the Vik prospect (fig. 2, no. 1). Rhyolitic intrusions, that may also contain volcanogenic deposits, crop out in the vicinities of Jones and Deep Creeks. Copper again occurs along fractures in overlapping andesite flows, and within these rhyolitic intrusions. The intrusions are capped by jasperoid and hematite, and contain disseminated pyrite. Drilling and underground development at the Red Ledge prospect and from Dyke mine revealed copper, zinc, silver, and gold resources. Exploration of the other intrusions in the study area may disclose additional mineral resources.

Fissure Veins

Gold-silver fissure veins generally are associated with intrusive contact zones. Scattered, the most important ones are near Jackley Mountain. Veins there were formed by circulation of metal-bearing solutions during the emplacement of dioritic rocks. The veins were controlled by fractures, in contrast to the volcanogenic deposits which are controlled by horizons. Most are poorly exposed.

MINING HISTORY

Early mining in the Rapid River study area centered in the Black Lake locale in the Seven Devils district. Rich gold placer deposits there were cleaned in the 1860's; underlying lode deposits were discovered in the 1880's. Lode deposits of the South Peacock and Peacock mines (fig. 2, nos. 16 and 18) were developed first.

Between 1897 and 1908, the principal period of mine development, rail lines were proposed to mines on Kinney Ridge (Hoover, 1974). The approach of rail links stimulated exploration and development work of a number of mineral prospects. Construction of a wagon road from Cuprum to West Fork Rapid River increased activity in the vicinity of Jackley Mountain. Work on most mineral prospects declined when the rail lines were abandoned in 1908.

Only sporadic mining took place in the Seven Devils district and Kinney Ridge between 1910 and the discovery of the Copper Cliff mine in the late 1960's. Most of the small amount of ore produced during this period came from lenticle deposits, although a small amount was also mined from veins and lenses. The complex oxides, carbonate, and sulfide-ores in most deposits was not amenable to concentration by methods known at the time. Local smelting failed because of the high costs and low recovery.

Exploration and mining revived in the late 1960's when the Copper Cliff, and its 10 million metric tons of disseminated volcanogenic copper-silver ore was discovered. The open pit mine and 1,000 t/d flotation mill is about 1.6 km east of the Windy Ridge local (fig. 2). In 1992 the mine was idle due to low metal prices.

At the Iron Dyke mine (fig. 2), in the Homestead mining district of Oregon, ore was outlined by drilling in the early 1970's. During periods of high metal prices, ore from the mine is treated at the Copper Cliff mill. The Iron Dyke mine was also idle, due to low metal prices.

In the 1970's, drilling at the Red Ledge prospect (fig. 2, no. 39), in the study area, disclosed deposits that may be minable; work on the Nix prospect (fig. 2, no. 7), also in the study area, disclosed other deposits.

Production

Between 1883 and 1976, recorded production from 23 metal mines within and near the Rapid River study area totaled at least 325,000 t (358,007 short tons) of ore (USBM files). This includes production from mines in the Seven Devils, Homestead, and Mountain View mining districts that are within 2 km of the study area. The ore yielded about 1.6 million g (50,000 oz) of gold, 59 million g (1.9 million oz) of silver, 15.3 million kg of copper, 36,000 kg of lead, 36,000 kg of zinc, and 82 kg of tungsten, all calculated to have been worth about $17 million at historic metals prices (table 3). Production from the residual placers over tactites was not recorded.

Recorded production from the 12 study area mines, between 1883 and 1968, totaled 51,175 t (56,410 short tons) of ore--Antz Creek (fig. 2, no. 4), Azurite (no. 3), Crackerjack (no. 6), Lime Peak (no. 11), Lockwood (no. 22), Maid of Erin (no. 43), Peacock (no. 36), River Queen (no. 5), South Peacock (no. 35), Summit (no. 42), Tussel (no. 21), Victory tungsten (no. 28), and White Monument mines (no. 23). This ore, predominately from tactite deposits near Windy Ridge, yielded 282,390 g (9,079 oz) of gold, 7,016,650 g (225,565 oz) of silver, 5,551,172 kg of copper, 1,132 kg of lead, 24,960 kg of zinc, and 82 kg of tungsten trioxide, all worth about $2 million at the times of production (Close and others, 1976). The average metal content of all study area ore was 5 g/t (0.1 oz/ton) gold, 52 g/t (1.5 oz/ton) silver, and 40.6 kg/t (4 percent) copper--worth about $21.60/t at the times of production ($165/short ton at 1992 prices).

TABLE 3.--Metal production from mines within or near the Rapid River study area.

[USBM, files; t, metric ton, g, gram; kg, kilogram; --, none recorded; and NR, not reported.]

Year(s)	Ore (t)	Gold (g)	Silver (g)	Copper (kg)	Lead (kg)	Zinc (kg)	Value ($)1/
1883-1903	29,802	137,009	3,012,948	4,515,504	--	--	$1,335,625
1904	7,539	63,139	2,106,762	257,340	--	--	$152,115
1905	5,534	43,389	895,766	489,240	--	--	$212,755
1906	2,445	5,132	292,524	303,632	--	--	$138,930
1907	494	1,866	57,541	17,395	--	--	$10,105
1908	236	156	39,967	56,013	--	--	$20,615
1909	104	311	17,729	19,203	--	--	$6,025
1910	503	4,354	17,884	7,176	--	--	$5,860
1911	912	3,421	30,481	97,089	--	--	$29,290
1912	122	311	30,014	25,157	--	--	$17,040
1913	204	2,488	44,166	52,575	--	--	$19,085
1914	930	5,910	12,597	14,455	--	--	$8,320
1915	4,572	11,819	325,337	205,358	--	--	$87,040
1916	21,864	18,351	2,843,747	191,893	--	--	$133,950
1917	33,421	39,812	976,945	635,643	--	--	$432,690
1918	30,618	118,036	762,335	744,481	--	--	$503,950
1919	25,129	334,513	559,387	957,762	--	--	$630,415
1920	31,639	258,777	592,357	1,075,685	--	--	$601,040
1921	2,177	13,530	41,678	78,958	--	--	$31,380
1922	15,568	86,155	448,039	467,582	--	11,416	$177,650
1923	17,019	98,597	747,561	787,586	562	--	$249,165
1924	13,558	58,474	436,531	339,234	485	9,391	$147,025
1925	2,849	11,664	111,038	47,837	--	15,574	$47,590
1926	4,785	15,863	113,370	113,814	--	--	$46,185
1927	14,710	25,349	258,155	220,348	--	--	$78,060
1928	2,558	4,665	44,477	38,032	--	--	$16,110
1929	36	156	9,642	12,009	--	--	$5,070

TABLE 3.--Metal production from mines within or near the Rapid River study area-continued.

Year(s)	Ore (t)	Gold (g)	Silver (g)	Copper (kg)	Lead (kg)	Zinc (kg)	Value ($)1/
1931	23	156	5,754	6,487	--	--	$1,320
1932	1	31	--	--	--	--	$20
1934	1	5,288	467	--	--	--	$5,890
1935	803	41,211	23,638	68	238	--	$46,980
1936	807	28,926	12,130	888	236	--	$32,660
1937	3,665	123,479	41,211	24,154	--	--	$21,450
1938	227	11,197	9,020	12,290	--	--	$15,825
1939	363	19,284	11,819	6,403	--	--	$23,290
1940	404	14,929	13,685	10,419	--	--	$19,545
1941	295	10,264	20,995	16,766	--	--	$18,455
1942	86	1,089	16,951	16,186	--	--	$5,910 2/
1943	82	933	30,014	16,852	--	--	$5,945
1944	200	311	16,640	24,521	--	--	$11,795
1945	77	156	13,530	13,142	--	--	$3,790
1946	27	311	6,221	6,161	1,812	--	$2,935
1947	113	156	15,552	19,196	--	--	$9,540
1948	14	467	2,799	2,908	--	--	$2,005
1949	50	156	10,108	13,137	--	--	$5,975
1950	41	--	5,599	--	13,975	--	$4,240
1951	104	156	11,819	8,342	11,248	--	$9,285
1952	68	--	3,421	--	7,610	--	$4,965
1953	218	--	--	--	--	--	$14,185
1955	9	--	467	879	--	--	$745
1956	9	--	1,711	1,812	--	--	$1,760
1958	18	--	311	2,537	--	--	$1,450
1960	204	156	37,013	36,199	--	--	$26,860
1961	971	1,555	166,712	15,493	--	--	$16,910
1962	812	778	102,484	98,437	--	--	$69,850
1963	381	467	42,922	40,815	--	--	$29,790

TABLE 3.--Metal production from mines within or near the Rapid River study area-continued.

Year(s)	Ore (t)	Gold (g)	Silver (g)	Copper (kg)	Lead (kg)	Zinc (kg)	Value ($)1/
1968	308	311	24,882	29,536	--	--	$29,250
1972	15,422	--	272,151	192,670	--	--	$228,730
1973	31,203	--	1,137,281	876,904	--	--	$1,232,730
1974-1976	NR	NR	1,137,281	876,904	--	--	$9,824,872
Totals	326,335	1,625,007	59,021,053	15,290,526	36,165	36,380	$16,872,037

1/ Extrapolation based on historic metal prices.
2/ Includes 82 kg of tungsten (WO^3) production.

Mining Claims

The 1974 records for Adams County listed the locations of at least 2,000 mining claims within the Rapid River study area since 1870; most were lode; a few were placer and millsite claims. The claims are concentrated along a northeast-trending zone extending from the Iron Dyke mine through Windy Ridge to the Rapid River (fig. 2). A total of 766 unpatented claims were current in 1992. The BLM (U.S. Bureau of Land Management) has record of 88 patented claims in the study area, covering about 700 ha; most are lodes, with a few being placer or millsite claims. The first patents were issued in the 1870's and the most recent in 1923.

MINERAL COMMODITIES

The metallic mineral resources ("resources" as defined by U.S. Bureau of Mines, and U.S. Geological Survey, 1980) in the Rapid River study area usually are in metallurgically complex deposits of sulfide-, oxide-, and carbonate-minerals of two or more metals (table 4). The principal metallic mineral commodities contained in the deposits, in decreasing order of past production, are copper, silver, and gold (table 5). Small amounts of lead, zinc, tungsten, and molybdenum were also produced; however, the molybdenum content of the tungsten ore made it unsalable.

Extensive nonmetallic mineral resources, limestone and sand and gravel, are also present in the study area. There is no evidence of petroleum or other energy resources.

Metallic Commodities

Copper

Averaging 40.6 kg/t (4 percent), most copper ores from the study area came from the South Peacock and Peacock tactite deposits (fig. 2, nos. 35 and 36). Future production would be from volcanogenic as well as

from tactite deposits. Small amounts of copper are also in the explored parts of Jackley Mountain veins. The copper content may increase with depth.

Silver

Ores from the study area averaged 52 g/t (1.5 oz/ton) silver. Most came from the South Peacock and Peacock tactite copper deposits. Silver is also an important constituent of most of the volcanogenic and tactite occurrences; future production would be from these occurrences, particularly those near Windy Ridge. Silver is a minor constituent of Jackley Mountain fissure veins.

Gold

Ores from the study area averaged 5 g/t (0.15 oz/ton) gold. Most came from the tactite deposits and was recovered as a by-product during refining. Future production would come mainly from volcanogenic- and tactite-copper ores. Gold is the principal commodity in the fissure veins near Jackley Mountain, and also is an important constituent around Windy Ridge. It occurs in enriched zones over some volcanogenic, tactite, and fissure veins. Gold content decreased with depth at most mines.

Zinc

Significant amounts of zinc occur in some of the volcanogenic and vein deposits near Windy Ridge and Jackley Mountain. One study area prospect, the Red Ledge, contains a zinc resource.

TABLE 4.--Estimate of mineral resources in Rapid River study area.
[g/t, gram per metric ton; --, small but possibly recoverable amounts.]

LOCALITY Site name	fig. 2, no.	Deposit type	Classification 1/	Metric tons	Gold (g/t)	Silver (g/t)	Copper (percent)
METALLIC MINERAL SITES **Windy Ridge**							
Allison Creek prospect	17	Volcanogenic	Occurrence	2,300	--	--	0.72
Cliff prospect	40	Do..	Do..	18,000	10	65	2.2
Crackerjack mine	6	Do..	Do..	2,900	--	250	1.4
Eureka prospect	8	Do..	Do..	83,000	--	0.32	.9
Lower Devil's Hollow prospect	33	Fissure vein	Do..	1,000	--	--	1.2
Peacock mine	36	Tactite	Resource	400,000	0.17	24	1.35
Red Ledge prospect 2/	39	Volcanogenic	Do..	23,000,000	2.1	41	.51
River Queen mine	5	Do..	Occurrence	6,000	--	--	1.5
South Peacock mine	35	Tactite	Resource	1,500,000	--	19	1.59
Subtotals	9 deposits			25,013,200			
Jackley Mountain							
Maid of Erin mine	43	Fissure-vein	Resource	220,000	4.1	3.4	--
Summit mine	42	Do..	Do..	74,000	4.1	--	--
Subtotals	2 deposits			294,000			
TOTALS	11 deposits			25,307,200			
NONMETALLIC MINERAL SITES **Windy Ridge**							
Snake River limestone	14	Bedded	Occurrence	Large	--	--	--
Isolated							
Rapid River limestone	61	Do..	Do..	Do..	--	--	--
Rapid River placers	60	Sand, gravel and gold	Do..	Do..	--	--	--
Subtotals	3 deposits						
TOTAL	3 deposits						

1/ The resource classification definitions are from U.S. Bureau of Mines and U.S. Geological Survey (1980).

2/ Also averages 1.32 percent zinc.

TABLE 5.--Summary of U.S. data for the principal mineral commodities in the Rapid River study area.

[Estimated data from U.S. Bureau of Mines (1993) unless noted; numbers in thousands unless noted; N, not available; %, percent; t, metric ton; kg, kilogram; g, gram; lb, pound; and oz, troy ounce.]

Commodities	Domestic mine production	Domestic consumption	Domestic reserve base	Major import sources	Net import reliance	Price used in report	Major uses
Copper	1,720 t	2,300 t	90,000 t	Canada, 46% Chile, 22% Mexico, 12%	3%	$2.36/kg ($1.07/ lb)	Building construction, 41%; electrical and electronic products, 24%; industrial machinery and equipment, 13%; transportation, 12%; and consumer and general products, 10%.
Silver	1,800 kg	270 kg	72,000 kg	Mexico, 41% Canada, 32% United Kingdom, 6% Peru, 6%	0%	$0.13/g ($4.00/ oz)	Photographic products, 50%; electrical and electronic products, 21%; and electroplated ware, sterlingware, and jewelry, 9%.
Zinc	520 t	1,225 t	50,009 t	Canada, 60% Mexico, 11% Peru, 5% Spain, 5%	34%	$1.25/kg ($0.59/ lb)	Construction, 45%; transportation, 20%; machinery, 12%; and electrical, 12%
Gold	320 kg	360 kg	5,050 kg	Canada, 50% Switzerland, 13% Chile, 6%	N	$9.34/g ($350/ oz)	Jewelry and arts, 70%; industrial (mainly electronics), 23%; and, dental, 7%.
Limestone and dolomite (crushed stone)	820 t	822 t	Adequate	Canada, 55% Mexico, 27% Bahamas, 14%	N	$5.32/t	Construction, chemical and metallurgical uses, and agricultural purposes.

Nonmetallic Commodities

Limestone

A small amount of limestone was produced from the study area. Used in the milling of gold ore from the Summit and Maid of Erin mines at the millsite near Black Lake (fig. 2, nos. 42-44), the limestone was mined from the large, metamorphosed, high grade beds along Rapid River (fig. 2, no. 61). This limestone is now inaccessible.

More accessible limestone is at the Snake River deposit (fig. 2, no. 14), in the Dry Gulch drainage of the Snake River canyon at the southwestern end of the study area. This deposit is crossed by the paved Hells Canyon Dam road. The Snake River limestone is part of the Martin Bridge formation. Similar deposits are mined at Lime, Oregon, about 64 km south of the study area.

The Snake River limestone occurs in nearly horizontal beds totaling 520 m in thickness. The beds crop out over an area of about 6,900 ha and are estimated to contain in excess of 45 billion t (50 billion short tons) of limestone. Limited sampling (appendix D) indicates the stone meets specifications for many uses; such as the manufacture of cement, lime, and soil amendments. However, the estimated cost to mine similar limestone elsewhere, by open pit methods, about equals its $5.32/t ($4.83 per short ton) value; thus, it cannot be transported far before costs exceed price. Because of this the Snake River limestone is classified an occurrence. These deposits could be utilized in the event of nearby construction.

Sand and gravel

Deposits of sand and gravel also occur in the study area. The largest deposit, the stream channel and terraces along Rapid River (fig. 2, no. 60) and its tributaries, contain about 7 million m^3 (9.1 million cubic yards) of gravel and sand. However, Rapid River was designated a Wild River (Public Law 94-199) and therefore the sand and gravel probably cannot be developed. Besides, no nearby markets exist.

Since the early 1900's, about 70 gold placer claims have been located on the gravel deposits along Rapid River and its tributaries. One claim was patented; located in 1902, the 30-ha High Five Placer (fig. 2, no. 44), near Black Lake, was patented in 1912. No workings were observed. It surrounds the Maid of Erin and Summit millsites and was probably located to obtain water and to insure access between the mill and Maid of Erin and Summit mines. The claim has been reconveyed to the U.S. Government.

Along Rapid River there is no evidence of placer development; no production has been recorded. Pan samples were taken on or near bedrock at 26 locations along the river and its tributaries. Three samples contained detectable gold; 4.1 miligrams of gold or less per cubic meter (0.003 ounce per cubic yard, a few cents worth). The gravel has little gold potential.

ECONOMIC CONSIDERATIONS

As mentioned, the study area's metallic resources (table 4) are contained in three main deposit types. In order of mining potential they are: 1) volcanogenic occurrences containing mainly gold, zinc, copper, and silver; 2) tactites containing mainly copper and silver, with small amounts of gold; and 3) veins containing mainly gold, with some silver and copper (table 4). The mining and milling techniques applicable to each deposit type is different, and so each was analyzed separately.

Mining and milling models, not specific to any particular roadless-area ore deposit, were designed and preliminary estimates of their capital- and operating-costs were made. These estimates were based on the simplified costing system described by Camm (1991).

It was assumed that characteristics of deposits would not change significantly with depth. Metallurgical-testing and additional pre-mining exploration (drilling and trenching) would be necessary to determine if the assumptions were correct. Following are descriptions of mining and milling methods used in the Rapid River study area in the past, and modern mining and milling plans possibly applicable to the deposits in the study area. The estimated recoverable values reported are calculations based on a recovery rate of about 81 percent, the average metal contents (grades) listed in table 4, and the metal prices listed in table 5.

Gold, Zinc, Copper, And Silver Resources At A Volcanogenic Site

Five volcanogenic-type deposits in the study area have yielded ore--Azurite, Antz Creek, River Queen, Crackerjack, and Lime Peak mines (fig. 2, nos. 3-6, and 11, respectively). The mineralized zones at all five are too poorly exposed or low grade to be classified resources. However, exploration would probably disclose resources. The one volcanogenic-type site in the study area best explored, amenable to recovery, and also large enough to be considered minable is the Red Ledge prospect (fig. 2, no. 39).

Previous mining of volcanogenic-type deposits in the Rapid River study area was by crude underground methods, with access through adits or shafts. The ore was handsorted for shipment to distant smelters. When grades declined to the point where the ore could no longer pay transportation costs, mining ceased. No local mills, to beneficiate lower grade material so that it could be transported, were ever built.

Proposed Mining Model

Assumptions for mining a resource similar to that at the Red Ledge prospect include upgrading access roads, and installation of powerlines and mining- and milling-equipment.

Costs would also be affected by geological and mining factors summarized in table 6, which were used to cost the mining model described in this report.

TABLE 6.--Summary of geological factors affecting proposed mining of a gold-, zinc-, copper-, and silver-bearing volcanogenic deposit.

Ore competence	Moderately competent
Wallrock competence	Fairly competent, bolting required
Tonnes of ore - mined and milled	22.7 million
Tonnes of ore milled per day	6,200
Mining days per year	260
Mine life	14.2 years

Underground mining was used for the model because of the ruggedness of the Red Ledge site; steep narrow canyon. Cheaper, and therefore preferable, open pit mining probably would not be economical because of the large amounts of waste that would soon be encountered. In addition, the Red Ledge site affords little room for mining and milling plants, or for tailings disposal. As much of the plant and tailings as possible would have to be put underground. Material not used for fill underground would probably have to be pumped to tailings ponds.

The geological characteristics of the ore and wall rock allow employment of the vertical crater retreat underground mining method[1]. This method allows; 1) a maximum recovery of the resource, as much as 90 percent; 2) a minimum mixing (dilution of about 10 percent) of ore with wallrock; and 3) minimum surface disturbance.

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[1] Vertical Crater Retreat (VCR): Used on vertical or steeply-dipping ore bodies. Down-the-hole drills often are used for production (ore breaking), with small jumbo drills being used for drift development. Load-haul-dump units comprise the machinery employed to move the ore. Development includes a haulage drift, raises for access to drill overcuts, undercut of the complete area below the stope, drawpoints, and overcut of the complete stope area along the top of the stope. The VCR stopes are excavated in horizontal slices starting from the bottom, and the broken ore can remain in the stope for support similar to shrinkage stoping (Camm, 1991, p. 14).

Proposed Milling Model

The ore milled would consist of the sulfides chalcopyrite, pyrite, sphalerite, galena, and tetrahedrite in a gangue of quartz, rhyolite, and andesitic volcanic rock, which has been kaolinized and coated by jarosite and limonite. Testing to determine recovery would have to be done for each deposit in the study area. For this report it was assumed the ore would be treated by standard flotation methods and at least 90 percent of the metals recovered.

For this model, milling costs were based on the USBM two product flotation mill model[2]. The mill product would consist of two concentrates, copper and zinc, to be shipped to smelters. A summary of the estimated mining and milling costs is presented in table 7.

TABLE 7.--Summary of estimated costs for proposed mining and milling of a gold-, zinc-,copper-, and silver-bearing volcanogenic deposit during a 14.2-year mine life.

	Million
Infrastructure, includes roads and power lines	$1.7
Mine capital costs	$33.0
Mine operating costs	$207.4
Mill capital costs	$43.2
Mill operating costs	$184.0
Tailings disposal	$12.2
Environmental - cleanup	$12.2
Total =	$493.7 1/

1/ Zero rate of return on investment.

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[2] Two Product Flotation Mill (TPFM) (Camm, 1991, p. 22): The TPFM process is the most often used where flotation will be used to produce two concentrates. Mine-run ore is crushed and sized in a series of crushers and vibrating screens. Crushed ore is then ground in a rod mill and passed through cyclones. The cyclone product is sent to rougher flotation cells and then onto cleaner cells. The cell product is then dried for shipment. Tails from the flotation cells are sent to a tailings pond.

The mine-and-milling models developed by the USBM show that a similar volcanogenic-type deposit, containing approximately 20 million t (22 million short tons) of gold-, zinc-, copper-, and silver-bearing resources, and in a remote location such as the study area, would have to have a total recoverable mineral value of about \$22/t (\$19.96 per short ton) to break even. The volcanogenic resources have an estimated recoverable value of about \$43/t (\$47 per short ton).

Copper and Silver Resources In Tactites

Between the 1880's and 1960's, copper- and silver-bearing tactite ore was produced from the Rapid River study area--mainly from the Peacock and South Peacock (fig. 2, nos. 36 and 35). Remaining resources at the two mines appear amenable to recovery. Following are descriptions of tactite mining methods employed in the study area in the past and suggestions for a possible mining and milling plan.

Early mining of tactites in study area was mainly by crude, underground methods--with access through shallow adits and shafts. In the 1960's, open pit mining methods yielded some ore. In the past, the ore was high-enough grade to allow handsorting to a grade that would pay transportation costs to distant smelters. When grades declined to where the ore could no longer pay transportation costs, mining ceased. No local mills, to upgrade the lower grade material, were ever built. Operation of nearby smelters, at Landore, was tried without success, largely due to the cost of importing charcoal or coke.

Proposed Mining Model

Assumptions for mining tactite resources similar to those in the study area include upgrading 10 km of access roads, and installation of powerlines and mining- and milling-equipment.

Costs of mining copper- and silver-bearing tactites resources would also be affected by the geological and mining factors summarized in table 8, which were used to cost the mining model described in this report.

The shallow depths of the tactites, along with their geological characteristics, would allow the employment of the USBM small open pit model for the mining method[3].

Proposed Milling Model

Optimum location for a mill would be where adequate water and room for the milling facilities are available. In the study area, such a site exists along Copper Creek near the tactites.

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[3] Small Open Pit: Used on small, shallow deposits. Equipment used to move ore and waste, broken by blasting, includes front-end loaders and diesel haul trucks. Haulage distance is the main cost factor (Camm, 1991, pp. 6 and 7).

TABLE 8.--Summary of geological factors affecting proposed mining of copper-and silver-bearing tactites.

Ore thickness-mining width.	22 m
Ore depth	Surface to 46 m
Ore competence	Incompetent
Wallrock competence	Mainly incompetent
Tonnes of ore - mined and milled .	1,880,000
Tonnes of ore milled per day . . .	960
Mining days per year	260
Mine life	7.6 years

The ore to be milled would consist of the copper- and silver-bearing minerals bornite, chalcopyrite, and chalcocite in a gangue of garnet, quartz, calcite, pyrite, and epidote; all coated by malachite, azurite, and chrysocolla. Testing to determine recovery would have to be done for each deposit. For this report it was assumed that the ore could be treated by standard flotation methods and at least 90 percent of the copper and silver recovered.

For this model, milling costs were based on the USBM one product flotation mill model[4]. The mill product would be a copper concentrate that would be shipped to a smelter.

A summary of the estimated costs is presented in table 9.

The mine-and-milling model, developed by the USBM, shows that tactite-type deposits containing approximately 2 million t (2.2 million short tons) of copper- and silver-bearing resources, and in a remote location such as the study area, would have to have a total recoverable mineral

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[4] One Product Flotation Mill (OPFM) (Camm, 1991, p. 21): The OPFM process is the most often used where flotation will be used to produce a single concentrate. Mine-run ore is crushed and sized in a series of crushers and vibrating screens. Crushed ore is then ground in a rod mill and passed through cyclones. The cyclone product is sent to rougher flotation cells and then onto cleaner cells. The cell product is then dried for shipment. Tails from the flotation cells are sent to a tailings pond.

TABLE 9.--Summary of estimated costs for proposed mining and milling of copper- and silver-bearing tactites during a 7.6-year mine life.

	Million
Infrastructure, includes roads and power lines	$2.5
Mine capital costs	$6.6
Mine operating costs	$6.4
Mill capital costs	$9.6
Mill operating costs	$24.4
Tailings disposal	$1.4
Environmental - cleanup	$1.4
Total =	$52.3 1/

1/ Zero rate of return on investment.

value of about $28/t ($25.40 per short ton) to break even. The tactite resources in the Rapid River study area have about this recoverable value. In general, larger deposits would require lower recoverable mineral values to break even.

Gold Resources In Fissure Veins

Gold ore was produced from two fissure-vein type deposits in the Rapid River study area--the Summit and Maid of Erin mines (fig. 2, nos. 42 and 43). Gold resources remaining at the two mines are amenable to recovery and are large enough to be considered minable, given a rise in the price of gold.

A mining-milling model for a fissure vein similar to those in the study area was designed and a preliminary estimate of its capital and operating costs made. Following are descriptions of past mining and milling practices employed in the study area, and a description of a possible mining and milling plan.

Mining at the Summit and Maid of Erin mines was by crude, underground methods with access through adits. The gold contained in the ore was free-milling or in pyrite, and so could be recovered on-site by tabling and cyanidization. However, gold losses in the mill (below Black Lake) were excessive, and mining unprofitable, due to the crude crushing methods used (grinding equipment was not available; thus, not enough of

the gold was liberated) (Close, 1974). The crude mining and milling methods were necessary because of the lack of a road adequate to handle reasonable quantities of ore and equipment.

Proposed Mining Model

Assumptions for mining similar fissure-vein resources include upgrading of about 20 km of access roads, and installation of powerlines and mining- and milling-equipment.

Mining costs would also be affected by the factors summarized in table 10, which were used to cost the mining model described in this report.

Underground mining would be required because of the steep-dipping nature of the veins. The geological characteristics of the veins and wall rock would allow employment of the vertical crater retreat underground mining method described previously for the volcanogenic deposits.

TABLE 10.--Summary of geological factors affecting proposed mining of gold-bearing fissure veins.

Ore thickness and mining width. . .	0.8 m
Ore attitudes	Northeast-trending and steeply dipping
Ore competence	Moderately hard
Wallrock competence	Fairly competent, bolting required
Tonnes of ore - mined and milled .	290,000
Tonnes of ore milled per day . . .	240
Mining days per year	260
Mine life	4.8 years

Proposed Milling Model

The optimum mill location would be where adequate water and room for the milling facilities are available; such a site exists below Black Lake. Ore milled would be mostly (90 percent) quartz containing gold. The remaining 10 percent of the mill feed would be wallrock added (by dilution) during mining. Testing to determine gold recovery would have to be done for each deposit. For this report it was assumed that the ore could be treated by standard cyanide-vat-leach methods and at least 90 percent of the gold recovered.

For this model, milling costs were based on the USBM carbon-in-leach - electrowinning (CIL) mill model[5]. The mill would include crushing and grinding and a combination of gravity and carbon-in-leach vat cyanidization to recover the gold. The mill product would be gold dore that would be shipped to a refinery.

A summary of estimated mining and milling costs is presented in table 11.

TABLE 11.--Summary of estimated costs for proposed mining and milling of gold-bearing fissure veins during a 4.8-year mine life.

	Million
Infrastructure, includes roads and power lines	$5.0
Mine capital costs	$2.9
Mine operating costs	$5.3
Mill capital costs	$3.1
Mill operating costs	$5.3
Tailings disposal	$0.8
Environmental - cleanup	$0.8
Total =	$23.2 1/

1/ Zero rate of return on investment.

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[5] Carbon-in-Leach - Electrowinning milling (CIL) (Camm, 1991, p. 18): The CIL process is the most often used in the processing of oxide gold ores with little or no by-products. Mine-run ore is initially crushed in a jaw- and cone-crusher circuit. Crushed ore is then ground in a semi-autogenous grinding mill and then sent through cyclones. The oversize is sent to a ball mill, while undersize is sent to the CIL circuit. Carbon is added in the CIL circuit, which consists of a series of tanks with high efficiency agitators. Carbon loaded with gold is then sent to stripping tanks. In these tanks the gold-bearing solution is stripped from the carbon and then sent to electrowinning cells where the gold is coated onto steel wool. The steel wool is treated with dilute sulfuric acid, and sent to a refining furnace, where gold ore is produced for shipment. The stripped carbon is regenerated in a kiln and returned to the circuit. A small gravity circuit to recover coarse gold could be added to this basic mill. This circuit would precede the leaching.

The mine-and-milling models, developed by the USBM, show that fissure veins similar to those in the study area, and containing approximately 300,000 t (330,000 short tons) of gold-bearing resources, would have to have a total recoverable mineral value of about $79/t ($71.67 per short ton) to break even. The fissure-vein resources in the area have an estimated recoverable value of about $91/t ($82.56 per short ton).

CONCLUSIONS

Identified in the Rapid River study area are five mineralized sites with significant metallic mineral resources; three are near Windy Ridge and two near Jackley Mountain. It is likely that additional metallic mineral resources would be delineated by exploration at the five sites, as well as at 34 other known sites. Also, mineral resources probably occur elsewhere along the northeast-trending zone between the Iron Dyke mine and Rapid River.

In the past, residual placers and copper-stained outcrops were significant indicators of hidden resources. In the future, geochemical sampling, followed by drilling, would be needed to outline resources.

Most ore produced from the study area came from tactite deposits. In the future these deposits could yield additional ore. However, study area deposits with the most potential for mining are large volcanogenic-type deposits such as the one at the Red Ledge prospect. Output from these deposits would mainly be gold, zinc, copper, and silver. They would, in most cases, be mined by underground methods and their complex ore concentrated by flotation.

Extensive limestone also occurs in the study area. Because of high purity and location near roads, the Snake River limestone has a potential for production. Although this potential is limited by the great distance to existing markets, the limestone could be used in local construction if the need develops.

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GENERAL DESCRIPTIONS OF MINERALIZED LOCALES

Sixty-one mineralized sites (mines and prospects) were examined during the USBM investigation of the Rapid River study area (fig. 2). Most are clustered in two locales--Windy Ridge and Jackley Mountain. Six of the 61 sites are isolated along upper Rapid River, outside the two principal mineralized locales--Black Leopard, Indian Springs, North Star Butte, Paradise Cabin, Trail Creek, and Twin Lakes prospects (fig. 2, nos. 57, 55, 56, 59, 58, and 54, respectively). The six are poorly exposed, or yielded samples with insignificant metal contents.

Described below are the two principal mineralized locales in the study area. Following that are descriptions (by locale in alphabetical order) of the five sites that have metallic-mineral resources and the 34 sites that could have resources (tables 1, 2, and 6), based on past production, exposed mineralized structures, or samples with significant metal contents.

In addition to the 39 significant metallic-mineral sites, there are three significant nonmetallic-mineral sites described previously--Snake and Rapid River limestone deposits (fig. 2, nos. 14 and 61), and Rapid River sand and gravel deposit (fig. 2, no. 60). Summary descriptions of 19 miscellaneous sites examined, those with rock exposures too poor to allow estimation of mineral resources or sites which yielded samples containing insignificant mineral concentrations, are in appendix B. Descriptions and analyses of samples are also listed with the property descriptions. Additional data for samples taken in 1992 are in appendix C. Analyses of limestone samples are in appendix D.

Windy Ridge

Setting

Windy Ridge, in the southwestern-part of the study area, is bounded on the west by the Snake River, on the east by the Snake River/Indian Creek divide, and on the north by Deep/Oxbow and the west Granite Creek divides (fig. 2). The village of Cuprum, on the eastern side of Windy Ridge, is about 56 km northwest by maintained Forest Service graveled road (no. 002) from Council, Idaho. Access to the northern-part of Windy Ridge from Cuprum is by maintained roads (nos. 072 and 106). Access to the southern part of Windy Ridge is via the paved Hells Canyon Dam road (no. 454) along the Snake River from the village of Oxbow, Oregon. Oxbow is about 97 km east by State Highway 86 from Baker, Oregon.

Many mineralized sites in the Seven Devils mining district are on Windy Ridge. Most are in canyons that are steep and grass-, brush-, and tree-covered. Mineralized structures are poorly-exposed, and generally only then in workings.

Since the 1870's, about 1,350 lode claims have been located along a 3.2-km-wide belt that trends northeasterly from the Iron Dyke mine, in

Oregon, just southwest of the study area, to beyond the Copper Cliff mine (fig. 2). Lode claims located prior to 1920 were mainly on tactites near the Peacock mine (fig. 2, no. 36). Claims located after 1920, particularly in the 1960's and 70's, were at volcanogenic deposits on the west side of Windy Ridge and along Deep Creek. Sixty-eight claims, covering 536 ha, were patented between 1870 and 1923; most are still privately owned. The largest patented group is the 41 claims covering about 332 ha at the Red Ledge prospect (fig. 2, no. 39). About 743 unpatented claims are currently (1992) held (fig. 2). Thirty-five placer claims, located since 1870 along the Snake River, were on deposits inundated by the Hells Canyon Reservoir.

History and Production

Residual gold placers, occurring on top of tactite copper deposits near the Peacock mine (fig. 2, no. 36) were discovered in the 1860's and claimed in the 1870's. The Peacock placer, the first claim in the study area, was patented in the 1870's. When the placer was depleted, development of the underlying copper deposits was begun, some time in the 1880's. Between 1883 and 1968, Windy Ridge tactite deposits, mainly the Peacock and South Peacock mines, but also the Lockwood, Tussel, Victory, and White Monument mines (fig. 2, nos. 36, 35, 22, 21, 28, and 23, respectively), yielded about 36,000 t (40,000 short tons) of ore containing about 58,000 g (1,900 oz) of gold, 6.7 million g (220,000 oz) of silver, 5.4 million t (5.6 million short tons) of copper, and 82 kg of WO^3 all worth about $1.8 million at the times of production (Close and others, 1976).

In the 1890's, small, high-grade volcanogenic-vein and -sulfide-bearing-lens deposits were discovered. They were sporadically explored and mined until the 1965 discovery of the Copper Cliff copper-silver deposit (fig. 2). The discovery of the Copper Cliff mine encouraged exploration, and between 1965 and 1980, nine major mining companies explored Windy Ridge. The Nix and Red Ledge prospects (fig. 2, nos. 7 and 39) were the focus of most exploration work, which included geologic mapping, sampling, geophysical and geochemical exploration, and drilling. The results were the discovery of copper, silver, zinc, and gold resources.

Between 1900 and 1956, recorded production from volcanogenic deposits on Windy Ridge amounted to about 1,700 t (1,900 short tons) of ore--mainly from the River Queen and Azurite mines, with some from the Lime Peak and Crackerjack mines (fig. 2, nos. 5, 3, 11, and 6, respectively). The ore yielded about 170 g (5 oz) of gold, 230,000 g (7,400 oz) of silver, 93,000 kg (200,000 pounds) of copper, 1,500 kg (3,200 pounds) of lead, and 25,000 kg (53,000 pounds) of zinc, all worth about $48,000 ($28/t [$31 per short ton]) at the times of production. Lead and zinc were produced only from the Azurite mine (Close and others, 1976).

In the past, development of mineral deposits on Windy Ridge was hampered by: 1) high transportation costs; 2) technological inability to make a marketable concentrate from low-grade, complex ores; and 3) the small

size and irregularity of high-grade deposits.

Economic Geology

The tactite deposits on Windy Ridge are in faulted blocks of limestone intruded by granodiorite. The north side of a 4.8-km-long, 0.16-to 1.6-km-wide roof pendant contains most of the deposits. The steeply north-dipping, marbleized limestone trends northwest from Landore (site) to the Peacock mine. An isolated tactite occurs at the Victory tungsten mine.

Malachite- and azurite-coated pods in limestone which has been partially to completely replaced by garnet, epidote, specularite, magnetite, and quartz, comprise the tactite deposits. The pods contain bornite, chalcocite, covellite, and minor amounts of pyrite, chalcopyrite, and native copper. Minor amounts of the tungsten-bearing minerals--scheelite and powellite--occur at a few sites. In the 1940's and 1950's, attempts to mine tungsten failed because of small size of deposits and the high molybdenum content, which prevented the production of a marketable tungsten concentrate.

The tactites on Windy Ridge were mined to shallow depths mainly by underground methods. Surface mining was tried in the 1960's, but was stopped when copper prices dropped. Drilling indicated the tactites extended below the workings. The largest deposit, at the South Peacock mine, contains an estimated 1.5 million t (1.6 million short tons) of copper and silver resources. Additional deposits may be found at depth along the contact zone, and drilling and sampling indicated that copper also occurs in the surrounding granodiorite. Additional tactite resources at the Peacock mine total at least 400,000 t (440,000 short tons) of copper- silver-bearing material.

The Windy Ridge volcanogenic resources occur as in sulfide-bearing lenses, veins, and disseminations. Drilling at the Red Ledge and the Nix prospects indicated large disseminated deposits around lenses and veins. Sulfides in veins and lenses are exposed at the surface or have been intersected by drill holes in the area between the Red Ledge prospect and the Antz Creek mine (fig. 2, no. 4). Prior to the 1960's, most work was on sulfide-bearing vein- and lens-deposits. In the 1960's and 70's, exploration was directed mainly toward lens and disseminated deposits.

The volcanogenic deposits are associated with pyrite-bearing rhyolite intrusions that are surrounded by extrusive rocks, limestone, and agglomerate. These rocks are leached, massively-bedded, northwest-trending, and gently to steeply dipping. The veins and massive sulfide lenses are concentrated near contacts between pyritic rhyolite intrusive and andesitic extrusive rocks. Disseminated deposits consisting of pyrite, chalcopyrite, and sphalerite blebs, associated with quartz veins and stringers, occur mainly in the rhyolite intrusive rocks.

The sulfide-bearing lenses on Windy Ridge are historically the most important volcanogenic deposits. They consist of northeast-trending, steeply dipping wallrock and quartz containing pyrite, chalcopyrite, chalcocite, bornite, and sphalerite, with minor galena. Most lenses are copper stained and secondarily enriched to a depth of 60 m. Azurite and malachite may occur along fractures for as much as 6 m on either side of the lenses. At the Red Ledge prospect, lenses are as thick as 20 m and more than 120 m long. They have been exposed by workings and intersected by drill holes at depths greater than 150 m. The lens at the River Queen mine (fig. 2, no. 5) averages 1.6 m thick and is exposed for 49 m along strike.

Trending northeast and dipping randomly, the volcanogenic vein deposits of Windy Ridge average less than 0.6 m thick; they are usually less than 61 m long. Composed of quartz with lesser amounts of calcite, dolomite, and siderite, they contain malachite- and azurite-coated tetrahedrite, chalcopyrite, bornite, chalcocite, sphalerite, and galena blebs and streaks.

The only volcanogenic deposit large enough and of high enough grade to be classified a resource is the Red Ledge prospect. It contains at least 23 million t of gold-, silver-, copper-, and zinc-bearing resources (table 6). The largest volcanogenic vein occurrence, the Cliff prospect (fig. 2, no. 40), contains an estimated 18,870 t.

The most important fissure vein on Windy Ridge is at the Lower Devil's Hollow prospect (fig. 2, no. 33). The vein is in granodiorite. It is limonite-, malachite-, and azurite-coated and contains chalcopyrite, covellite, and bornite. This small vein occurrence totals at least 1,000 t. A number of other fissure-vein prospects in the area may have mineral resources (table 1).

Jackley Mountain

Setting

Jackley Mountain, in the northeastern part of the study area, includes gold prospects near the headwaters of West Fork Rapid River, and Granite, Copper, and Paradise Creeks (fig. 2). The locale is about 27 km north by rough mountain roads (nos. 105 and 112) from the village of Bear, Idaho.

History and Production

Gold-bearing quartz fissure-veins in this part of the study area were discovered in 1887, and most of the 654 lode and millsite, and 34 placer claims located by 1910. These claims lay along a zone trending northeast from Black Lake. Covering about 135 ha, nineteen lode claims at the Maid of Erin and Summit mines, and the Mayflower prospect (fig. 2, nos. 43, 42, and 53, respectively) were patented by 1914. In addition, the High Five Placer claim and the Maid of Erin and Summit millsites (fig. 2, no. 44), covering about 29 ha, were patented by 1914.

Five unpatented claims were held in 1992.

Records show production from the Summit and Maid of Erin mines between 1902 and 1915, and in 1937. The two mines yielded about 13,000 t (14,000 short tons) of ore containing 220,000 g (7,000 oz) of gold and 47,000 g (1,500 oz) of silver, worth about $150,000 at the times of production (Close and others, 1976). Between 1902 and 1916, the ore was treated in a 45-tonne-per-day (50-short-ton-per-day) cyanide mill on the Maid of Erin and Summit mill sites near Black Lake. Limestone, used in the milling, was mined from nearby deposits on Rapid River. In 1937, gold ore from the two mines was treated in a cyanide mill at the Placer Basin mine (fig. 2), about 13 km south by road from Black Lake.

Discovery of fissure veins north of Jackley Mountain led to construction of the 23-tonne-per-day (25-short-ton-per-day) Rankin custom mill on West Fork Rapid River in 1902 (fig. 2). It also resulted in mine development on Copper and Paradise Creeks and the settlement of the town of Iron Springs in 1903. By 1920, mining activities in the area stopped because of the short working season, high mining costs, and lack of year-round transportation facilities.

Economic Geology

As thick as 5 m, and averaging 1.2 m, the veins near Jackley Mountain trend between N. 15° and 80° E. and dip steeply. Composed of quartz containing gold, pyrite, and chalcopyrite pods and disseminations, the veins fill shear zones along contact zones between metamorphosed volcanic-and dioritic-rock. Sulfides occur in narrow veins or where the veins pinch. The free-milling gold ore was apparently mined from shallow, oxidized deposits over sulfide pods. When the sulfides were encountered, mining became uneconomic because of lower grades and the lack of milling equipment.

Two lodes near Jackley Mountain have resources. The veins at the Maid of Erin and Summit mines are as thick as 0.9 m and up to 400 m long. They contain combined resources of at least 294,000 t (324,000 short tons) (table 6). Select samples of oxidized vein material had as much as 45.6 g/t (1.3 oz/ton) gold, 75 g/t (2.2 oz/ton) silver, and 0.91 percent copper. The vein at the Curren Mountain prospect (fig. 2, no. 47) is likely to have resources. Additional, undiscovered, high-grade oxide deposits, and deeper, sulfide-bearing veins, probably occur in the area.

DESCRIPTIONS OF SIGNIFICANT WINDY RIDGE MINERALIZED SITES

NAME: Allison Creek prospect (copper)

INDEX MAP NO.: Fig. 2, no. 17

LOCATION: NE. 1/4 SW. 1/4 sec. 28, T. 21 N., R. 3 W.; lat (latitude) 45°07′37"N., long (longitude) 116°42′32"W; 3.4 km east of Hells Canyon Reservoir.

ELEVATION: 1,100 m

ACCESS: By road 24 km north from the village of Oxbow, Oregon then 3.2 km east by cross-country travel.

GEOLOGY OF DEPOSIT: A limonite-stained, sulfide-bearing lens, as thick as 0.6 m, strikes N. 40° to 60° E. and dips 50° NW. in red andesite porphyry. Andesite bedding strikes N. 10° to 20° E. and dips 40° NW. Chalcocite and bornite stringers pervade the lens, and malachite is along fractures for 1.5 m on either side.

WORKINGS: There are four small prospect pits.

SAMPLING: Three chip samples across the lens contained 0.15 to 2 percent copper.

CONCLUSIONS: The lens averages 0.4 m thick, is exposed for 66 m along strike, and contains at least 2,300 t (2,500 short tons) grading 0.72 percent copper. It is an occurrence that is too small to be classified a resource. Exploration would likely disclose resources along strike.

NAME: Antz Creek mine (copper, silver, gold)

INDEX MAP NO.: Fig. 2, no. 4

LOCATION: NE. 1/4 sec. 27, T. 20 N., R. 4 W; lat 45°02′27"N., long 116°48′28"W.; about 0.4 km east of Hells Canyon Reservoir.

ELEVATION: 730 m

ACCESS: By the paved Hells Canyon Dam road 9.6 km north from Oxbow then by dirt road 0.4 km east.

PRODUCTION: Company officials (oral commun., Canyon View Mining Company) reported two carloads (72 t) of ore were shipped in the 1950′s.

GEOLOGY OF DEPOSIT: A volcanogenic vein is in bedded andesite striking N. 15° E. and dipping 20° SE. The vein is along a 1.5-m shear zone striking N. 45° E. and dipping 18° NW. (fig. A-1). The zone is composed of clayey gouge, breccia, and massive white quartz. The quartz occurs along the footwall of the shear zone, is as thick as 0.3 m, and contains copper-stained, tetrahedrite, bornite, and pyrite.

WORKINGS AND FACILITIES: In 1974 there were two open adits (fig. A-1, nos. 1 and 2), one with a stope, with a total length of about 160 m. There also were a caved adit, less than 15 m long, an open cut, a shop, and about 0.8 km mine road. In 1992, all of the workings were caved and the road and shop had been removed.

SAMPLING: Fourteen samples were taken; they indicated metals are confined to quartz (table A-1). Five chip samples across quartz (nos. 4, 6, 7, 10, and 12) averaged 79 g/t (2.3 oz/ton) silver and 0.22 percent copper. A grab sample of sulfide-bearing quartz (no. 1) assayed 0.3 g/t (0.01 oz/ton) gold, 1,900 g/t (54 oz/ton) silver, 3.5 percent copper, 1.15 percent zinc, 2.6 percent antimony, and 0.37 percent arsenic.

CONCLUSIONS: The vein has high grade stringers. Exploration for mineral resources along the northerly projection of the vein may be warranted. The persistence of the shear zone and its high metal content suggest mineral resources.

TABLE A-1.--Descriptions and analyses of samples from the Antz Creek mine.

[m, meter; g/t, gram per metric ton; Tr, trace.]

	Sample					
(fig. A-1, no.)	Type	Length (m)	Description	Gold (g/t)	Silver (g/t)	Copper (percent)
1 1/	Grab	NA	Sulfide-bearing quartz from 0.9-t stockpile	0.3	1900	3.5
2	Do..	NA	Do..	Tr	267	.89
3	Chip	6.1	Across country rock	0	3	.038
4	Do..	.1	Across vein	Tr	62	.23
5	Do..	27.4	Along wallrock	0	7	.004
6	Do..	.3	Across vein	0	3	.007
7	Do..	.1	Do..	0	0	.005
8	Do..	13.7	Along wallrock	0	0	.002
9	Do..	33.5	Do..	0	0	.002
10	Do..	.3	Across vein	.3	158	.38
11	Do..	.5	Across shear zone	0	31	.013
12	Do..	.3	Across vein	Tr	99	.34
13	Do..	4.6	Along shear zone	0	10	.009
14	Do..	15.2	Along wallrock	0	21	.014

1/ Also assayed 1.15 percent zinc, 2.6 percent antimony, and 0.37 percent arsenic.

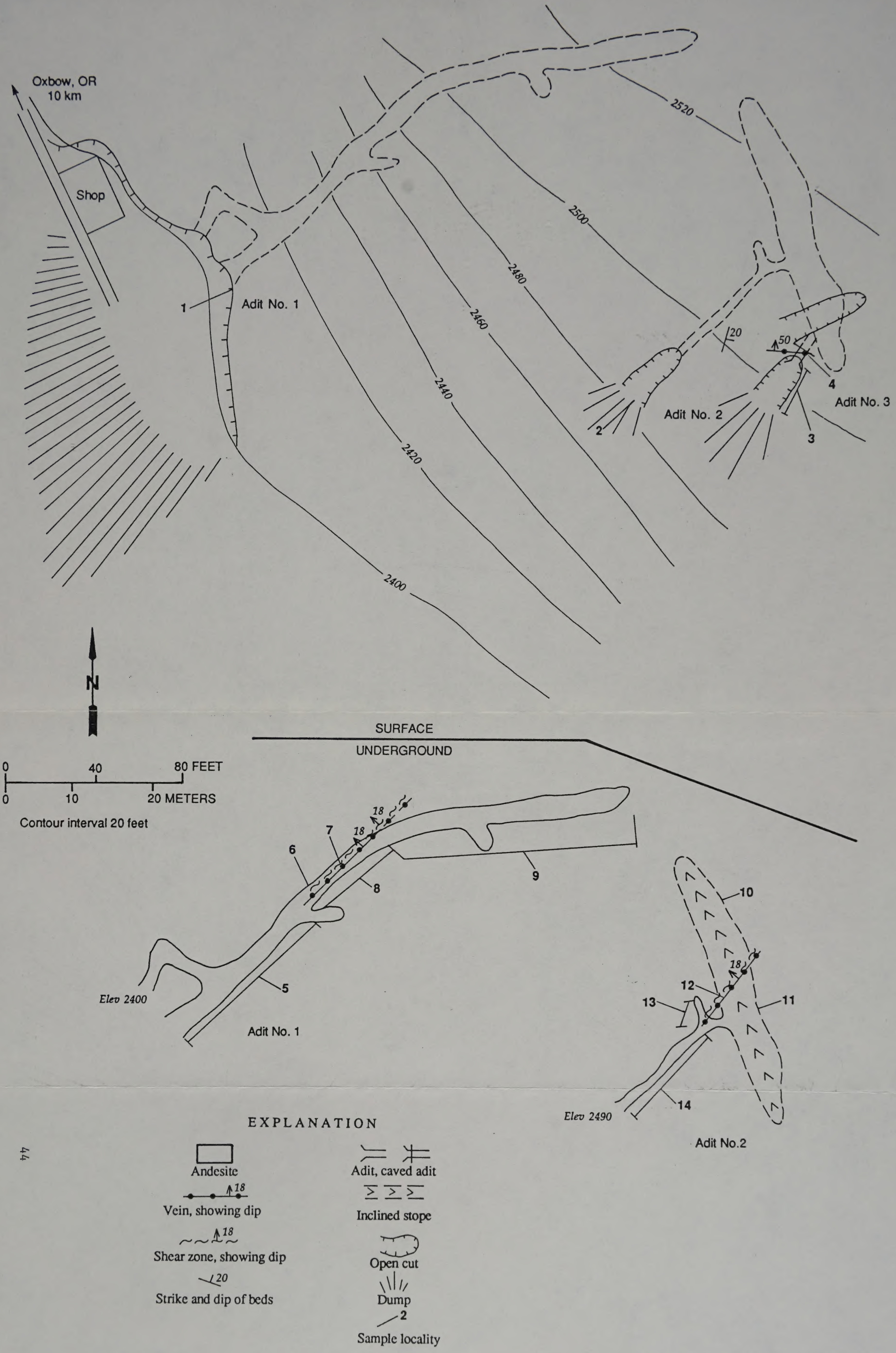

Oxbow, OR
10 km
Shop
1
Adit No. 1
2520
2500
2480
2460
2440
2420
2400
20
50
2
Adit No. 2
4
Adit No. 3
3
N
0
40
80 FEET
0
10
20 METERS
Contour interval 20 feet
SURFACE
UNDERGROUND
18
18
7
6
8
9
5
Elev 2400
Adit No. 1
10
18
12
11
13
14
Elev 2490
Adit No.2
EXPLANATION
Andesite
18
Vein, showing dip
18
Shear zone, showing dip
20
Strike and dip of beds
Adit, caved adit
Inclined stope
Open cut
Dump
2
Sample locality

Figure A-1.- Antz Creek mine

NAME: Azurite mine (silver, copper, lead, zinc, gold)

INDEX MAP NO.: Fig. 2, no. 3

LOCATION: NE. 1/4 sec. 26, T. 20 N., R. 4 W.; lat 45°02'25"N., long 116°47'18"W.; about 2 km east of Hells Canyon Reservoir.

ELEVATION: 853 to 1,220 m

ACCESS: Southwest 8.8 km by road then 0.4 km by trail from the village of Cuprum, Idaho.

HISTORY: The six claims of the Azurite group were located in 1898 and 1900. The Azurite lode claim, covering 8.1 ha, was patented in 1937 (MS-1937). Ore was shipped in 1900, 1901 and from 1918 until 1925. The mine has been idle since and the principal underground workings are caved. The mine was examined by Marsh (1929); his descriptions of underground workings, geology, and mineralogy are used in the following report.

PRODUCTION: Marsh (1929) reported that 360 t of ore, worth about $23/t, were produced in 1900 and 1901. Between 1918 and 1925, produced were 1,167 t of ore that yielded 4 g (0.1 oz) of gold, 173,026 g (5,560 oz) of silver, 14,666 kg of copper, 1,046 kg of lead, and 24,961 kg of zinc worth about $14,230 at the times of production (Close and others, 1976). The average grade of this production was 148.3 g/t (4.3 oz/ton) silver, 12.6 kg/t copper, 0.9 kg/t lead, and 21.4 kg/t zinc worth $12.20/t ($13 per short ton) at the times of production. This is the only recorded lead and zinc production from the Rapid River study area.

GEOLOGY OF DEPOSIT: The mine is in bedded andesite and rhyolite tuff. Paralleling Azurite Gulch and transecting the rocks is a shear zone striking N. 60° W. and dipping 65° NE. The zone is filled by well-defined, volcanogenic quartz veins with calcite, barite, dolomite, and siderite. The vein mined, contains shoots of bornite, sphalerite, tetrahedrite, pyrite, galena, and chalcopyrite. This vein is as thick as 1.5 m and is exposed by mine workings for 120 m along strike. Extensions of it or other veins are indicated by quartz on the dumps of trenches along Azurite Gulch 305 m and 610 m southeast of the mine.

WORKINGS: The mine, now caved, consists of a 23-m-deep shaft and two adits that are 30 m apart vertically. The upper adit was driven along the principal vein for 91 m. The first 61 m of the lower adit crosscuts country rock, and the last 76 m follows the vein (Marsh, 1929, p. 5). In the 1.3 km^2 area around the mine are at least 10 dozer trenches and connecting dozer trails.

SAMPLING: Four samples were taken in the vicinity of the mine by the USBM in 1974; three additional samples (nos. R56-R58) were taken in 1992. The samples taken in 1974 are described below; the samples taken in 1992 are also described below and listed in appendix B.

One of the four samples taken in 1974, a chip sample across leached vein in the caved adit on the east side of Azurite Gulch, assayed 17 g/t (0.5 oz/ton) silver, 0.03 percent copper, 0.1 percent lead, and 0.003 percent zinc. A chip sample from the footwall contained 34 g/t (0.1 oz/ton) silver, 0.01 percent copper, and 0.004 per cent zinc. A chip sample from the hangingwall assayed 3.4 g/t (0.1 oz/ton) silver, 0.01 percent copper, 0.02 percent lead, and 0.05 percent zinc. A select sample of sulfide-bearing vein material from adit dump had 3.4 g/t (0.1 oz/ton) gold, 439 g/t (12.8 oz/ton) silver, 0.72 percent copper, 0.05 percent lead, and 1 percent zinc. A sample, of vein material selected from the adit dump on the west side of Azurite Gulch, assayed 69 g/t (2 oz/ton) silver, 0.11 percent copper, and 0.13 percent zinc.

A grab sample (R56) taken from the mine dump in 1992, assayed 170 ppb gold, 375 g/t (10.9 oz/ton) silver, 0.49 percent copper, 35,200 ppb mercury, 0.05 percent lead, and 5.1 percent zinc. A grab sample (R57) of vein material, from a trench on Azurite Gulch about 305 m above the mine, had 105 ppb gold, 24 g/t (0.71 oz/ton) silver, 0.09 percent copper, 37,100 ppb mercury, and 0.81 percent zinc. A grab sample (no. R58) of vein material from another trench on Azurite Gulch, about 610 m above the mine, had 50 ppb gold, 24 g/t (0.64 oz/ton) silver, 0.09 percent copper, 27,450 ppb mercury, and 0.81 percent zinc.

CONCLUSIONS: Where exposed, the vein contains high grade material and appears to be persistent. Underground exploration would probably disclose resources.

NAME: Cliff prospect (copper, gold, silver)

INDEX MAP NO.: Fig. 2, no. 40

LOCATION: SE. 1/4 sec. 14, T. 22 N., R. 3 W.; lat 45°14′37"N., long 116°39′50"W.; on the north side of Oxbow Creek about 1 km above its confluence with Deep Creek.

ELEVATION: 1,100 m

ACCESS: By road 46 km north from Oxbow to Eagle Bar then via the Red Ledge prospect road east 8 km.

HISTORY: The prospect was discovered in 1896.

GEOLOGY OF DEPOSIT: Country rock is rhyolite that is silicified, sericitized, and pyritized. The rock contains a vuggy, copper-stained, volcanogenic quartz vein striking N. 50° to 20° W. and dipping 35° to 45° NE. (fig. A-2). The vein contains pyrite, chalcopyrite, cuprite, and bornite.

WORKINGS: A 107-m long adit was driven along the vein.

SAMPLING: Six chip samples were taken at intervals across the vein

(table A-2).

CONCLUSIONS: Exposed for 150 m along strike, the vein averages 0.3 m thick. It contains at least 18,000 t grading 10 g/t (0.3 oz/ton) gold, 65 g/t (1.9 oz/ton) silver, and 2.2 percent copper. The vein is high grade but too small to be classified a mineral resource. Exploration would probably disclose resources. The vein could be mined in conjunction with the Red Ledge if that deposit is mined.

TABLE A-2.--Descriptions and analyses of samples from the Cliff prospect.

[m, meter; g/t, gram per metric ton; Tr, trace.]

	Sample					
(fig. A-2, no.)	Type	Length (m)	Description	Gold (g/t)	Silver (g/t)	Copper (percent)
1	Chip	0.5	Across vein	Tr	44.57	0.78
2	Do..	.5	Do..	5.83	154.28	5.7
3	Do..	1.0	Do..	3.43	30.86	1.7
4	Do..	.5	Do..	35.31	102.86	1.1
5	Do..	.9	Do..	0	37.71	3.1
6	Do..	.4	Do..	35.66	99.43	.5

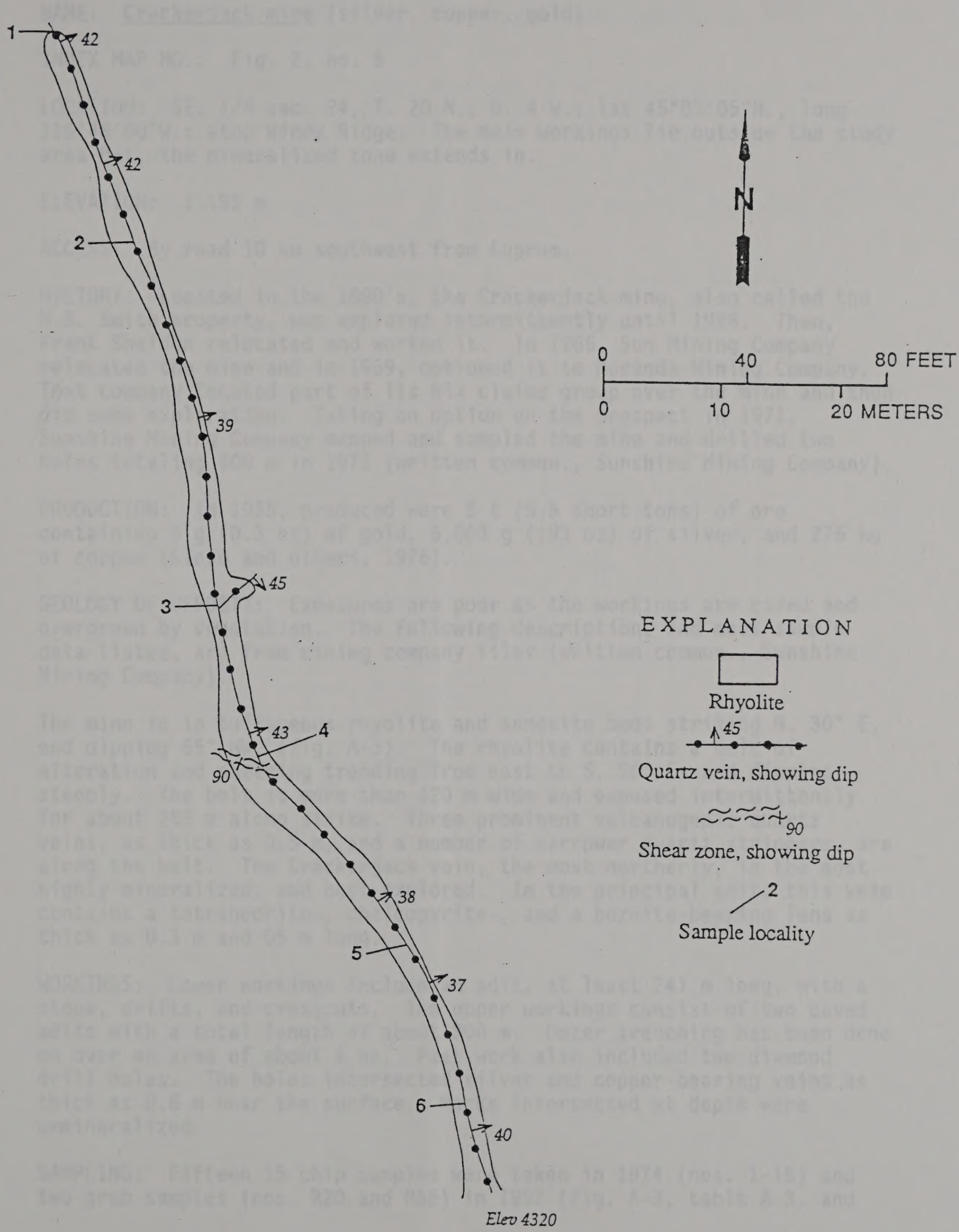

1
42
42
2
39
45
3
43
4
90
38
5
37
6
40
Elev 4320
N
0
40
80 FEET
0
10
20 METERS
EXPLANATION
Rhyolite
45
Quartz vein, showing dip
90
Shear zone, showing dip
2
Sample locality

Figure A-2.- Cliff prospect

NAME: Crackerjack mine (silver, copper, gold)

INDEX MAP NO.: Fig. 2, no. 6

LOCATION: SE. 1/4 sec. 24, T. 20 N., R. 4 W.; lat 45°03'05"N., long 116°46'00"W.; atop Windy Ridge. The main workings lie outside the study area but, the mineralized zone extends in.

ELEVATION: 1,195 m

ACCESS: By road 10 km southwest from Cuprum.

HISTORY: Located in the 1890's, the Crackerjack mine, also called the H.B. Smith property, was explored intermittently until 1928. Then, Frank Sheldon relocated and worked it. In 1965, Sun Mining Company relocated the mine and in 1969, optioned it to Noranda Mining Company. That company located part of its Nix claims group over the mine and then did some exploration. Taking an option on the prospect in 1971, Sunshine Mining Company mapped and sampled the mine and drilled two holes totaling 400 m in 1972 (written commun., Sunshine Mining Company).

PRODUCTION: In 1935, produced were 5 t (5.5 short tons) of ore containing 9 g (0.3 oz) of gold, 6,003 g (193 oz) of silver, and 276 kg of copper (Close and others, 1976).

GEOLOGY OF DEPOSIT: Exposures are poor as the workings are caved and overgrown by vegetation. The following description, and most sample data listed, are from mining company files (written commun., Sunshine Mining Company).

The mine is in tuffaceous rhyolite and andesite beds striking N. 30° E. and dipping 65° NW. (fig. A-3). The rhyolite contains a belt of alteration and shearing trending from east to S. 50° E. and dipping steeply. The belt is more than 120 m wide and exposed intermittently for about 256 m along strike. Three prominent volcanogenic quartz veins, as thick as 0.5 m, and a number of narrower quartz stringers, are along the belt. The Crackerjack vein, the most northerly, is the most highly mineralized, and best explored. In the principal adit, this vein contains a tetrahedrite-, chalcopyrite-, and a bornite-bearing lens as thick as 0.3 m and 85 m long.

WORKINGS: Lower workings include an adit, at least 241 m long, with a stope, drifts, and crosscuts. The upper workings consist of two caved adits with a total length of about 300 m. Dozer trenching has been done on over an area of about 4 ha. Past work also included two diamond drill holes. The holes intersected silver and copper-bearing veins as thick as 0.6 m near the surface. Rocks intersected at depth were unmineralized.

SAMPLING: Fifteen 15 chip samples were taken in 1974 (nos. 1-15) and two grab samples (nos. R20 and R55) in 1992 (fig. A-3, table A-3, and

appendix C). Six samples (nos. 10-15) were taken across the sulfide-bearing part of the vein.

CONCLUSIONS: At the lower adit, the lens is 0.3 m thick and can be projected 85 m. Averaging 250 g/t (7.2 oz/ton) silver and 1.4 percent copper it is an occurrence totaling about 2,900 t (3,200 short tons). Exploration for resources is warranted.

TABLE A-3.--Descriptions and analyses of samples from the Crackerjack mine.

[m, meter; g/t, gram per metric ton; Tr, trace; NA, not applicable; sample nos. 1-15 were taken in 1975, and nos. R20 and R55 in 1992.]

	Sample					
(fig. A-3, no.)	Type	Length (m)	Description	Gold (g/t)	Silver (g/t)	Copper (percent)
1	Chip	0.2	Across vein	0	4.11	0
2	Do..	.5	Do..	0	9.60	0
3	Do..	.2	Do..	0	Tr	0
4	Do..	.2	Do..	0	5.49	0
5	Do..	.2	Do..	Tr	4.11	0.1
6	Do..	.2	Do..	0	3.43	0
7	Do..	3.7	Across vein and wallrock	0	Tr	0
8	Do..	.3	Across vein	0	Tr	0
9	Do..	10.7	Across shear zone	Tr	7.54	0
10	Do..	.5	Across displaced part of vein	Tr	147.43	.88
11	Do..	.3	Do..	Tr	301.71	1.8
12	Do..	.2	Across vein	Tr	970.27	5.6
13	Do..	.2	Do..	Tr	462.85	2.7
14	Do..	.4	Do..	Tr	30.86	.18
15	Do..	.4	Do..	0	1.37	.01
R20	Grab	NA	From dump, quartz	0.34	1.03	.018
R55	Do..	NA	Do..	.75	99.08	.013

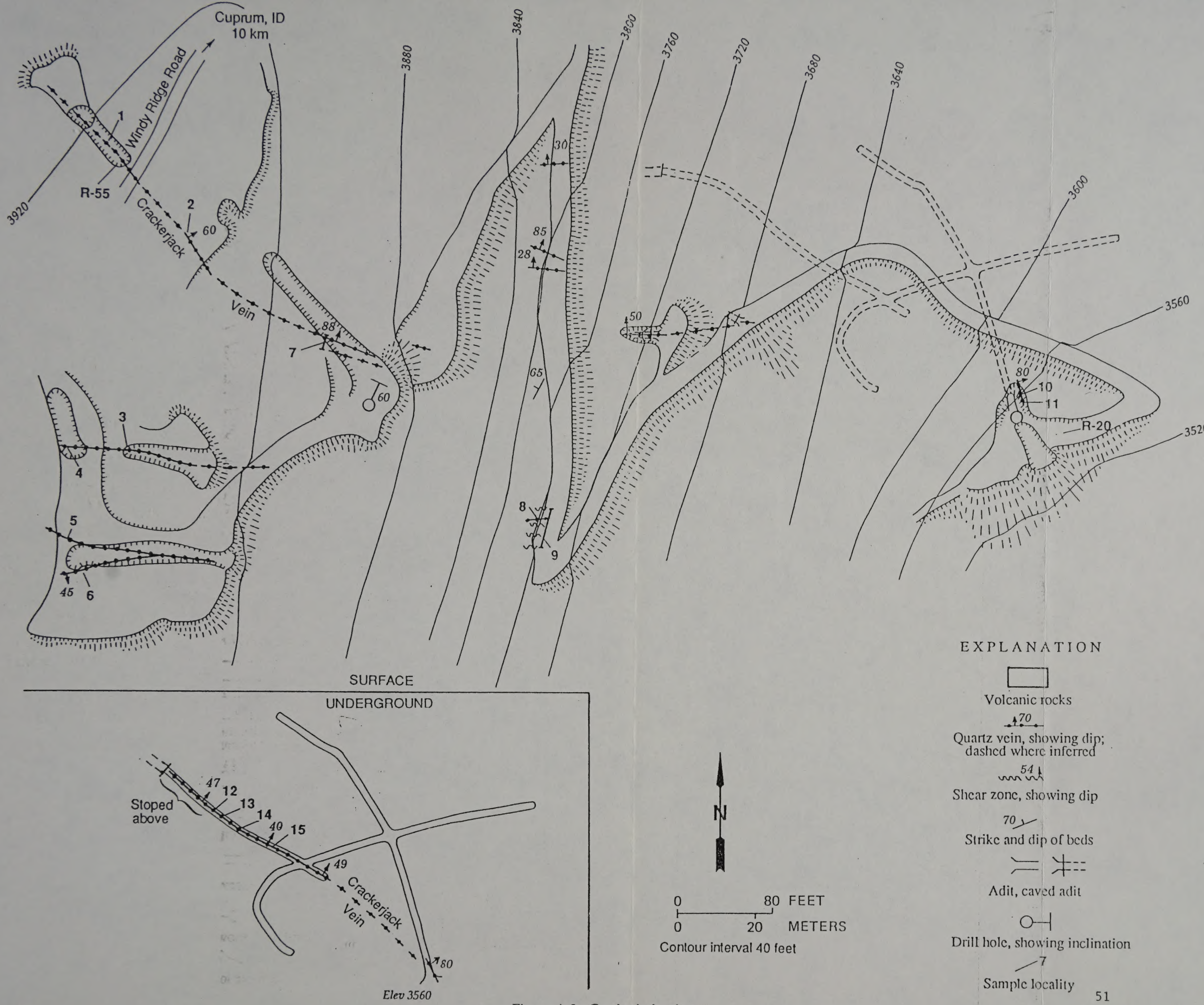

Cuprum, ID
10 km
Windy Ridge Road
Crackerjack
Vein
R-55
1
2
3
4
5
6
7
8
9
10
11
R-20
60
88
60
30
85
28
65
50
80
45
3920
3880
3840
3800
3760
3720
3680
3640
3600
3560
3520
SURFACE
UNDERGROUND
Stoped above
47
12
13
14
40
15
49
Crackerjack
Vein
80
Elev 3560
N
0
80 FEET
0
20 METERS
Contour interval 40 feet
EXPLANATION
Volcanic rocks
70
Quartz vein, showing dip; dashed where inferred
54
Shear zone, showing dip
70
Strike and dip of beds
Adit, caved adit
Drill hole, showing inclination
7
Sample locality

Figure A-3.- Crackerjack mine

NAME: Devil's Hollow prospect (copper, silver, gold)

INDEX MAP NO.: Fig. 2, no. 31

LOCATION: SE. 1/4 SE. 1/4 sec. 12, T. 21 N., R. 3 W.; lat 45°09′56"N., long 116°38′46"W.; near the head of Deep Creek.

ELEVATION: 2,130 m

ACCESS: By road 14 km north from Cuprum to the Peacock mine, then cross-country 2.4 km easterly.

GEOLOGY OF DEPOSIT: The prospect is underlain by granodiorite with a quartz vein striking N. 70° to 80° W. and dipping 50° NE. The vein is 0.2 m thick and contains malachite and bornite.

WORKINGS: There are one caved adit, estimated to be less than 30 m long, and three prospect pits.

SAMPLING: One select and one chip sample were taken. The select sample, of mineralized quartz, contained 21 g/t (0.6 oz/ton) gold, 34 g/t (1 oz/ton) silver, and 3.2 percent copper. The chip, sample across the vein, had 7 g/t (0.2 oz/ton) silver and 0.15 percent copper.

CONCLUSIONS: The poorly exposed vein contains high-grade material. Exploration would probably disclose mineral resources.

NAME: Dry Gulch prospect (copper, silver, gold)

INDEX MAP NO.: Fig. 2, no. 18

LOCATION: SW. 1/4 sec. 21, T. 21 N., R. 3 W.; lat 45°08′25"N., long 116°42′50"W.; in Dry Gulch about 1.6 km east of Hells Canyon Reservoir.

ELEVATION: 1,070 m

ACCESS: By road 24 km north from Oxbow, then cross-country 1.6 km easterly.

GEOLOGY OF DEPOSIT: A malachite-coated, volcanogenic, sulfide-bearing lens, striking east and dipping 65° N., is in limonite-stained, porphyritic rhyolite beds striking N. 60° W. and dipping 65° SW. The lens exposure is 0.2 m thick and 61 m long.

WORKINGS: There are four small prospect pits.

SAMPLING: One chip sample across the lens assayed 0.67 percent copper. A select sample of malachite-coated lens material from a small dump contained 0.7 g/t (0.02 oz/ton) gold, 254 g/t (7.4 oz/ton) silver, and 5.8 percent copper. A sample of dump material assayed 0.02 percent copper.

CONCLUSIONS: Lack of exposure precludes a resource estimate. Subsurface exploration along the strike and dip of the lens would probably disclose resources.

NAME: Eureka prospect (copper, silver, gold)

INDEX MAP NO.: Fig. 2, no. 8

LOCATION: NE. 1/4 sec. 18, T. 20 N., R. 3 W.; lat 45°04′50"N., long 116°44′46"W.; on the summit of Windy Ridge.

ELEVATION: 1,220 m

ACCESS: By road 8 km southwest from Cuprum.

HISTORY: The Eureka nos. 1 and 2 lode claims were located in the 1960′s.

GEOLOGY OF DEPOSIT: Andesite beds, striking N. 30° to 40° E. and dipping 20° to 40° NW., contain a zone of iron- and malachite-coated fractures, and bornite-, and chalcocite-bearing, volcanogenic lenses. The mineralized zone strikes east to N. 60° W. and dips 60° to 70° N.

WORKINGS: There are three prospect pits and more than 610 m of dozer trenching.

SAMPLING: Four chip samples were from across a 13-m thick portion of the zone, and another three were taken across a 8.2-m-thick portion 73 m west. They contained as much as a trace gold, 41 g/t (1.2 oz/ton) silver, and 1.9 percent copper. Five chip samples from adjacent rocks averaged trace silver and copper.

CONCLUSIONS: The zone averages 12 m thick, is exposed along strike for 72 m, and totals at least 83,000 t (91,000 short tons) grading 11 g/t (0.32 oz/ton) silver and 0.9 percent copper. Exploration along possible extensions would probably disclose mineral resources.

NAME: Golden Star prospect (copper, gold, silver)

INDEX MAP NO.: Fig. 2, no. 10

LOCATION: SE. 1/4 SW. 1/4 sec. 12, T. 20 N., R. 4 W.; lat 45°04′47"N., long 116°46′22"W.; about 1,500 m east of Hells Canyon Reservoir.

ELEVATION: 550 m

ACCESS: By road 15 km north of Oxbow then by trail and cross-country 1,500 m east.

HISTORY: The claim was located in 1956.

GEOLOGY OF DEPOSIT: An 2.4-m-thick, 14 m-long volcanogenic lens, containing pyrite, chalcopyrite, and malachite, is in red andesite porphyry. The lens strikes N. 40° E. and dips 20° NW; the andesite bedding strikes N. 25° E. and dips 25° NW.

WORKINGS: Two adits, one 6 m above the other, are in the lens. They are 44 m and 24 m long, respectively; and connected by a stope.

SAMPLING: Three chip samples, taken across the lens, assayed from 0.53 to 3.3 percent copper. They also contained trace amounts of gold and silver. Two wallrock chip samples had as much as 0.01 percent copper.

CONCLUSIONS: The lens is a small occurrence averaging 1.6 percent copper. Subsurface exploration would probably disclose more lenses in the vicinity.

NAME: Haily Ridge prospect (copper, gold)

INDEX MAP NO.: Fig. 2, no. 37

LOCATION: NE. 1/4 NE. 1/4 sec. 11, T. 21 N., R. 3 W.; lat 45°10′39"N., long 116°39′33"W.; on the divide between Hells Canyon Reservoir and Copper Creek.

ELEVATION: 2,160 m

ACCESS: By road 13 km north from Cuprum.

GEOLOGY OF DEPOSIT: No mineralized structure is exposed. Material on the dumps and alignment of workings, indicate a tactite zone trends northeast is in calcareous volcanic rock altered to greenstone by intrusion of granodioritic rock. The greenstone is limonite-stained and contains quartz, epidote, pyrite, and malachite.

WORKINGS: Four small prospect pits and a caved adit, about 4.5 m long, are in a 60 m by 40 m area.

SAMPLING: Two grab samples, of fractured material taken from the dumps during the previous study, had trace and 1.4 g/t (0.04 oz/ton) gold, and 0.58 and 1.7 percent copper, respectively. Two other samples, taken in 1992 (nos. R1-R2, appendix C), had 7 and 3,520 ppb (trace and 0.11 oz/ton) gold, and 147 ppm and 1 percent copper, respectively.

CONCLUSIONS: The samples indicate a mineral resource potential.

NAME: Heady prospect (copper, silver)

INDEX MAP NO.: Fig. 2, no. 38

LOCATION: SW. 1/4 sec. 25 and NW. 1/4 sec. 36, T. 22 N., R. 2 W.; lat

45°12′25"N., long 116°39′15"W.; on the north side of Deep Creek about 7 km upstream from it confluence with the Snake River (fig. 2, no. 39)

ELEVATION: 1,460 to 2,040 m

ACCESS: By road 46 km north from Oxbow to Eagle Bar, then by the poorly maintained Red Ledge prospect road and Deep Creek forest trail 11.5 km east.

HISTORY: The prospect was located in the 1890′s by Thomas Heady, patented in the 1900′s, and reconveyed to the U.S. Government in the 1950′s.

GEOLOGY OF DEPOSIT: The prospect is in an extension of the Red Ledge rhyolite intrusion. Rocks consist of lightly limonite-stained, sericitized, pyritic-, porphyritic-rhyolite that is sheared along a northeast trend. The shear zones are as thick 1.2 m and contain pods of volcanogenic-chalcopyrite, -sphalerite, and -galena.

WORKINGS: Main workings are on Deep Creek and consist of two northeast-trending, caved adits that total about 150 m. Workings to the north, along the divide between Deep and Oxbow Creeks, consist of two prospect pits. No mineralized structures are exposed in the pits, only altered, pyrite-bearing rhyolite.

SAMPLING: Four chip samples, across the leached mineralized shear zones exposed at the caved adits, assayed as much as 7 g/t (0.2 oz/ton) silver and 0.15 percent copper. Two grab samples, from adit dumps, had as much as 7 g/t (0.2 oz/ton) silver and 0.16 percent copper. A chip sample, of rhyolite exposed in the pits on the divide between Deep and Oxbow Creeks, contained 0.03 percent copper.

CONCLUSIONS: The intrusion and shear zones are too poorly exposed to ascertain their potential. The Red Ledge intrusion extends south to the Heady prospect and drilling at the Red Ledge prospect disclosed resources. Similar work at the Heady prospect may disclose additional resources.

NAME: Hibble Gulch prospect (copper, gold, silver)

INDEX MAP NO.: Fig. 2, no. 13

LOCATION: NE. 1/4 NW. 1/4 sec. 6, T. 20 N., R. 3 W.; lat 45°06′10"N., long 116°45′00"W.; 2.4 km east of Hells Canyon Reservoir.

ELEVATION: 1,100 m

ACCESS: By road 19 km north from Oxbow then cross-country 2.4 km east.

GEOLOGY OF DEPOSIT: Country rock is red andesite porphyry beds striking N. 32° E. and dipping 45° NW. In the andesite is a 1.2-m-thick

volcanogenic lens of malachite-coated wallrock; dump material indicates it contains chalcocite. The lens strikes N. 25° E., dips 80° SE. and is exposed intermittently in pits for 60 m.

WORKINGS: There are three prospect pits.

SAMPLING: Four samples were taken. Two chip samples, across lens exposures in pits, assayed as much as 0.01 percent copper. Two grab samples, of malachite-stained chalcocite-bearing dump material, averaged trace gold, 17 g/t (0.5 oz/ton) silver, and 2.7 percent copper.

CONCLUSIONS: The lens contains high-grade pods but, overall, is too poorly mineralized to be classified a mineral resource. It is wide and persistent, and probably has mineral resources at depth.

NAME: Lime Peak mine (copper, silver, gold)

INDEX MAP NO.: Fig. 2, no. 11

LOCATION: Secs. 11 and 12, T. 20 N., R. 4 W.; lat 45°05′02"N., long 116°46′02"W.; about 1 km east of Hells Canyon Reservoir.

ELEVATION: 490 to 1,100 m

ACCESS: By road 13 km north from Oxbow.

HISTORY: The mine was located prior to 1900 by the Lime Peak Copper Company. In the 1930′s and 1940′s, that company drove about 610 m of adit, but intersected no mineralized zones (fig. A-4, nos. 12-21). In the 1950′s, Ralph Page relocated 11 lode claims, in 1964 they were surveyed for patent (MS-3570); no patent was issued (oral commun., Ralph Page).

PRODUCTION: In 1927, Lime Peak Copper Company shipped 10 t of ore that yielded 7 g (0.2 oz) of gold, 1,773 g (57 oz) of silver, and 1,527 kg copper (Close and others, 1976). The ore probably came from one of the caved workings.

GEOLOGY OF DEPOSIT: Country rock is bedded, fractured, red, porphyritic andesite striking N. 10° to 20° E. and dipping 15° to 25° NW. The rocks contain reefs of limestone, such as the one that forms Lime Peak. The rocks also contain malachite-, limonite-, chalcocite-, bornite-, and tetrahedrite-bearing volcanogenic lenses; malachite stains fractures adjacent to the lenses.

WORKINGS: In mineralized rocks are four prospect pits and six adits, totaling about 730 m. An addition eleven prospect pits and trenches are in unmineralized rock.

Three pits, at locality nos. 1-3, are on a zone of malachite-coated

fractures and sulfide-bearing lenses striking N. 50° E. and dipping vertically.

A 23-m-long adit and a pit, at locality nos. 4-6, are on a malachite-coated, chalcocite-bearing lens striking N. 40° E. and dipping 40° NW.

The portal of the caved adit (locality no. 7) exposes a 3-m-thick, N. 60° E. striking, 65° NW. dipping zone of malachite-coated fractures.

Three east-trending adits totaling 30 m, at locality nos. 9-11, are on a N. 70° W. striking, vertically dipping, malachite stained, chalcocite- and bornite-bearing lens.

SAMPLING: Twenty chip and one grab samples were taken (table A-4).

CONCLUSIONS: Copper-bearing lenses are scattered along a 240 m-wide zone extending at least 1,590 m in a northeasterly direction.

The mineralized zone at sample locality nos. 1 and 2 averages 1.5 m thick, is about 31 m long, and grades 0.8 percent copper.

The lens at locality nos. 4 and 5 is 0.9 m thick, at least 31 m long, and grades 7 g/t (0.2 oz/ton) silver and 2.4 percent copper.

The mineralized zone exposed at sample locality nos. 9 and 10 averages 0.8 m thick, is about 27 m long and grades 7 g/t (0.2 oz/ton) silver and 1.3 percent copper.

The poorly exposed fractures and lenses all are too small to be classified resources. The zone in which they occur is persistent and largely unexplored; exploration would probably disclose resources.

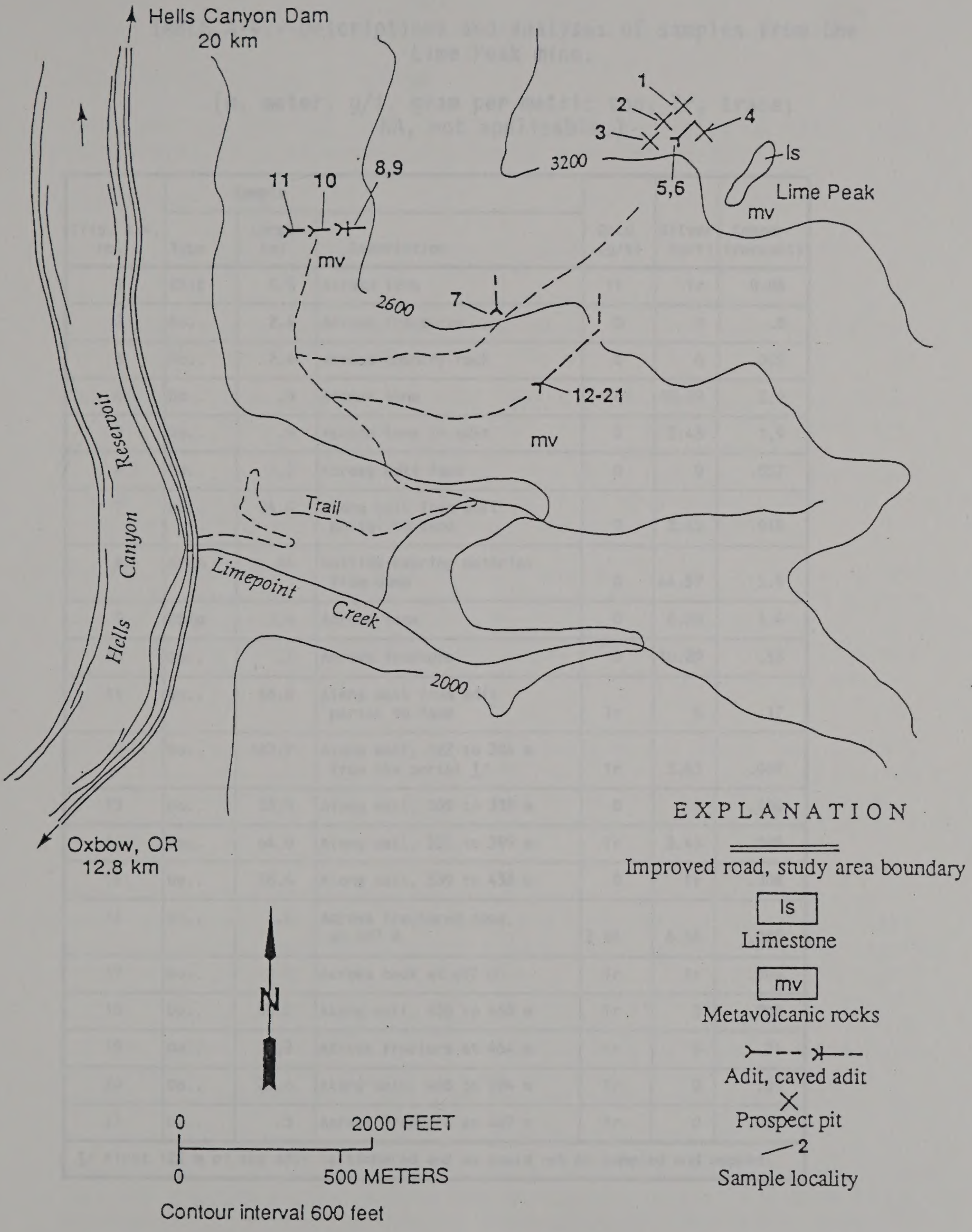

Hells Canyon Dam
20 km
1
2
3
4
5,6
ls
Lime Peak
mv
3200
11
10
8,9
mv
2600
7
12-21
mv
Hells Canyon Reservoir
Trail
Limepoint Creek
2000
Oxbow, OR
12.8 km
N
0
2000 FEET
0
500 METERS
Contour interval 600 feet
EXPLANATION
Improved road, study area boundary
ls
Limestone
mv
Metavolcanic rocks
Adit, caved adit
Prospect pit
2
Sample locality

Figure A-4.- Lime Peak mine

TABLE A-4.--Descriptions and analyses of samples from the Lime Peak mine.

[m, meter; g/t, gram per metric ton; Tr, trace; NA, not applicable.]

Sample				Gold (g/t)	Silver (g/t)	Copper (percent)
(fig. A-4, no.	Type	Length (m)	Description			
1	Chip	0.5	Across lens	Tr	Tr	0.08
2	Do..	2.4	Across fractures	0	0	.8
3	Do..	2.4	Across country rock	0	0	.009
4	Do..	.9	Across lens	0	10.29	2.9
5	Do..	.9	Across lens in adit	0	3.43	1.9
6	Do..	1.2	Across adit face	0	0	.037
7	Do..	24.4	Along wall from adit portal to face	0	3.43	.015
8	Grab	NA	Sulfide-bearing material from dump	0	44.57	5.9
9	Chip	1.4	Across lens	0	6.86	1.4
10	Do..	.3	Across fracture	0	10.29	.33
11	Do..	68.6	Along wall from adit portal to face	Tr	0	.17
12	Do..	182.9	Along wall, 122 to 304 m from the portal 1/	Tr	3.43	.009
13	Do..	30.5	Along wall, 305 to 335 m	0	0	.006
14	Do..	64.0	Along wall, 335 to 399 m	Tr	3.43	.005
15	Do..	38.4	Along wall, 339 to 438 m	0	Tr	.008
16	Do..	3.4	Across fractured zone, at 407 m	2.06	6.86	.085
17	Do..	1.2	Across back at 407 m	Tr	Tr	.004
18	Do..	30.5	Along wall, 438 to 468 m	Tr	0	.008
19	Do..	.2	Across fracture at 464 m	Tr	0	.01
20	Do..	25.6	Along wall, 468 to 494 m	Tr	0	.01
21	Do..	.3	Across fracture at 469 m	Tr	0	.025

1/ First 122 m of the adit is timbered and so could not be sampled and mapped.

NAME: Lockwood mine (copper, silver, gold, tungsten, molybdenum)

INDEX MAP NO.: Fig. 2, no. 22

LOCATION: SW. 1/4 sec. 24 , T. 21 N., R. 3 W.; lat 45°08′06"N., long 116°39′01"W.; 1.6 km northeast of Horse Mountain lookout.

ELEVATION: 1,890 m

ACCESS: By road 9.6 km north from Cuprum.

HISTORY: The three lode claims comprising the Lockwood mine, E.B. Lockwood, Pomeroy, and Lookout, cover about 16.8 ha, were located in 1884 and 1886, and patented in 1899 (MS-1386).

PRODUCTION: Between 1907 and 1945, 171 t of ore yielded 591 g (19 oz) of gold, 43,358 g (1,394 oz) of silver, and 44,936 kg of copper; all worth about $26,120 ($153/t [$170 per short ton]) at the times of production (Close and others, 1976). In 1953, tungsten was discovered and an unrecorded amount produced. The high molybdenum content of the tungsten-bearing mineral--powellite, made mining uneconomic.

GEOLOGY OF DEPOSIT: The mine is on irregular, N. 35° W. striking, 30° to 80° NE. dipping, tactite zones. The tactites are along the western edge of limestone beds intruded by granodiorite. The tactites, composed of garnet and other lime-silica minerals, are coated by malachite and chrysocolla; they contain bornite, chalcopyrite, specularite, and powellite.

WORKINGS: There are two adits, one 46 m above the other, and a shaft 120 m above the upper adit (Cook, 1954, p. 16). The upper adit is 43 m long; the lower measures 88 m. At the adits, ore was taken from a chimney-shaped body of copper-bearing tactite. The 9-m-deep shaft is on a similar tactite.

SAMPLING: A 0.46-m-long chip sample, from the tactite in the upper adit, contained 1 percent molybdenum and 0.65 percent WO_3 (Cook, 1954, p. 17). In the lower adit, a 2.1-m-long chip sample across the tactite contained 0.05 percent WO_3 (Cook, 1954, p. 17). The content of eight chip samples, from across the tactite zone between the adits, ranged from 3.4 to 13.7 g/t (0.1 to 0.4 oz/ton) silver and from 0.005 to 0.91 percent copper. No molybdenum or tungsten were detected. A 0.4 m-long chip sample, from the tactite in the shaft, contained 9.95 percent copper, 2.24 percent WO^3, and 0.85 percent molybdenum (Cook, 1954, p. 17).

CONCLUSIONS: Too small and scattered to be classified resources, the tactites exposed at the surface are circular; usually less than 9.8 m across, and 31 m long, and have a low average (0.3 percent) copper content. At depth the tactites may contain high grade pods. Subsurface work could disclose resources.

NAME: Lower Devil's Hollow prospect (copper, gold)

INDEX MAP NO.: Fig. 2, no. 33

LOCATION: SW. 1/4 NW. 1/4 sec. 7, T. 21 N., R. 2 W.; lat 45°10'28"N., long 116°38'00"W.; on the south side of Deep Creek.

ELEVATION: 1,950 m

ACCESS: By road 14 km north from Cuprum to the Peacock mine then cross-country 1.6 km east.

GEOLOGY OF DEPOSIT: The prospect is in jointed granodiorite. The joints strike N. 85° E. and dip 35° to 45° SE; some are filled by quartz veins. One mineralized vein is limonite-, malachite-, and azurite-stained, and contains chalcopyrite, covellite, and bornite.

WORKINGS: There is a 12-m-long crosscut adit, and a caved crosscut adit estimated to be 45 m long. The adits are parallel and about 24 m apart.

SAMPLING: Three 0.1 to 9 m long chip samples, across quartz-filled joints in the open adit and at the portal of the caved adit, contained from 0.07 to 1.3 percent copper. Two of these chip samples, 0.2 and 0.9 m long, across the mineralized vein extending between the adits, averaged 1.2 percent copper. A select sample from the adit dumps contained 6.2 g/t (0.18 oz/ton) gold, 1,860 g/t (54.3 oz/ton) silver, and 8.5 percent copper.

CONCLUSIONS: Exposed intermittently for 36 m along the trend of the jointing, the mineralized quartz vein averages 0.6 m thick. It is an occurrence of at least 1,000 t (1,100 short tons) grading 1.2 percent copper. While too small to be classified a resource, exploration would probably disclose mineral resources along strike and dip.

NAME: Lyles Saddle prospect (silver, copper, gold, lead, mercury)

INDEX MAP NO.: Fig. 2, no. 15

LOCATION: SW. 1/4 sec. 4, N. 1/2 sec. 8, and NW. 1/4 sec. 9, T. 20 N., R. 3 W.; lat 45°05'23"N., long 116°43'50"W.; atop the divide between Hells Canyon Reservoir and Indian Creek.

ELEVATION: 1,463 to 1,676 m

ACCESS: By road 1.9 km southwest from Cuprum.

GEOLOGY OF DEPOSIT: Fine-grained andesitic metavolcanic rock hosts a poorly-exposed fissure-vein striking N. 10° W. and dipping 90°. The vein is mainly drusy quartz containing pyrite, bornite, and malachite.

WORKINGS: For 1.6 km along the ridge in the vicinity of Lyles Saddle

are at least 10 dozer pits and trenches, and a caved drift estimated to be at least 18.3 km long.

SAMPLING: Three samples were taken, all in 1992. A 0.15-m-long chip sample (R51), across the quartz vein exposed in the adit 0.75 km west of Lyles Saddle, assayed 0.07 g/t (0.002 oz/ton) gold, 161 g/t (4.69 oz/ton) silver, 0.82 percent copper, 45,125 ppb mercury, and 0.3 percent lead. A 0.54-m-long chip sample (R15) of metavolcanic rocks exposed in the wall of a trench at Lyles Saddle had no significant metal content. A 1.2-m-long chip sample (R50) of silicified metavolcanic rocks exposed in the wall of a trench just east of Lyles Saddle also had no significant metal content.

CONCLUSIONS: The vein sample suggests that resources could be at depth.

NAME: Nix prospect (copper, silver)

INDEX MAP NO.: Fig. 2, no. 7

LOCATION: Secs. 31, 32, 34, and 35, T. 21 N., R. 3 W.; secs. 3-10, 17, and 18, T. 20 N., R. 3 W.; and secs. 12-14, and 23-27, T. 20 N., R. 4 W.; lat 45°04’08"N., long 116°46’20"W.; along the east side of Hells Canyon Reservoir (fig. A-5).

ELEVATION: 520 to 1,680 m.

ACCESS: By road about 6 km southwesterly from Cuprum, Idaho.

HISTORY: Also called Smith claims, exploration of the copper- and silver-bearing quartz veins and lenses at the Nix prospect began in the 1890’s. By the 1920’2 many adits, prospect pits, and trenches had been excavated; however, the small mineralized structures encountered discouraged further development.

In 1965, exploration to the north of the Nix prospect by Noranda Mining Company resulted in the discovery of the Copper Cliff volcanogenic copper-silver deposit (fig. 2) (oral commun., Nick Smith and Sunshine Mining Company). At the same time, Sun Mining Company located the Sun group of claims south of the Copper Cliff deposit. In 1969, Noranda secured options on the Sun claims, and located 168 Nix and 100 Axe claims over them. The Nix group was located on the Snake River side of Windy Ridge, in the study area, and the Axe group on the Indian Creek side of the Ridge, outside the study area.

Noranda did geochemical sampling on the Axe claims, and diamond drilled a 6-m-deep hole (not shown on fig. A-5). Also in 1969, Noranda leased the Nix prospect and Copper Cliff mine to Silver King Mining Company. Silver King located an additional 120 claims. After failing to find extensions of the Copper Cliff deposit on the Nix claims, Silver King dropped them. Sunshine Mining Company then optioned the Nix and Axe claims in 1971. In 1971 and 1972 they drilled two holes, totaling 1,700

m, on targets outlined by geochemical and geophysical prospecting (fig. A-5 and table A-5, near nos. 8 and 9). The holes intersected considerable pyrite but uneconomic amounts of copper. In 1975, Rosario Mining Company, under a joint agreement with Sunshine Mining Company, explored the Nix and Axe claims, again with negative results.

GEOLOGY OF DEPOSIT: The Nix prospect is underlain by intensely fractured and faulted volcanic rocks. The rock consist typically of metamorphosed, massively-bedded, gray andesite, and red andesite porphyry (keratophyre or greenstone); however, they also include pyritic-rhyolite and andesite, dacite, basalt, tuff, tuff breccia, limestone, and agglomerate. Bedding generally trends northeast and dips gently northwest. The rocks are intruded by numerous rhyolite and basalt dikes, sills, and small rhyolitic bodies; they are cut by northeast-trending, and weak north-trending systems of fractures.

Four types of volcanogenic mineral occurrences are on the claims. They consist of; 1) the more common, chalcocite and bornite-bearing lenses and stringers in malachite- and limonite-coated volcanic rock; 2) disseminated blebs of pyrite with chalcopyrite and bornite, encountered mainly by drilling; 3) quartz-carbonate fissure-veins containing tetrahedrite, chalcopyrite, bornite, galena, pyrite, chalcocite, malachite, and azurite streaks and lenses; and 4) malachite stained fractures.

WORKINGS: The Nix prospect, covering about 2,230 ha, encompasses or adjoins the patented Paducah prospect, Azurite claim, and River Queen mine. The Nix prospect also encompasses or is adjoined by unpatented prospects--Hibble Gulch prospect, North Lime Peak prospect, Antz Creek mine, Lime Peak prospect, Golden Star prospect, and Eureka prospect.

The Nix prospect is along a mineralized zone which is as wide as 3.2 km. The zone begins at Iron Dyke mine and trends northeast through Antz Creek and beyond Copper Cliff mine.

The most recent work was concentrated in upper Inca Gulch and at the head of Lime Point Creek where mineral occurrences were indicated by surface exposures, and by geochemical and geophysical surveys. Two diamond drill holes, totaling 1,310 m, in Inca Gulch intersected volcanic rock containing as much as 20 percent pyrite, chalcopyrite, and bornite.

The claimed area has also been explored by numerous adits, prospect pits, and trenches. However, only workings which expose, or are indicated by dump material to be on, mineral occurrences were sampled.

The data obtained during the USBM examinations of two open adits and nine caved adits, totaling about 610 m, 16 prospect pits, and 12 trenches is summarized in table A-5. Mineralized sites on the encompassed or adjoining prospects are described elsewhere.

SAMPLING: At the Nix prospect a total of 48 samples were taken, 47 in

g. on targets outlined by geochemical and geophysical prospecting (ill. A-5 and Davis 1972, near map 8 and 9). The holes intersected noneconomic pyrite but uncommon amounts of copper. In 1975, Noranda Mining Company, under a joint agreement with Sunshine Mining Company, explored the Rix and Cox claims, again with negative results.

GEOLOGY OF DEPOSIT. The Rix prospect is underlain by Lakeneck's fractured and faulted volcanic rocks. The rock consists typically of metamorphosed, massively-bedded, gray andesite, and red andesitic porphyry (plagioclase or granulite); however, they also include pyritic-argillite and rhyolite, dacite, basalt, tuff, tuff breccia, limestone, and conglomerate. Bedding generally trends north-east and dips steeply northwest. The rocks are intruded by numerous rhyolite and basalt dikes, sills, and small rhyolitic bodies; they are cut by northeast-trending, and weak north-trending systems of fractures.

Four types of volcanogenic mineral occurrences are on the claims. They consist of: 1) the more common, chalcocite and bornite-bearing lenses and stringers in malachite- and limonite-coated volcanic rock; 2) disseminated blebs of pyrite with chalcopyrite and sphalerite, encountered mainly by drilling; 3) quartz-carbonate fissure veins containing tetrahedrite, chalcopyrite, bornite, galena, pyrite, chrysocolla, malachite, and azurite streaks and lenses; and 4) malachite-stained fractures.

WORKINGS. The Rix prospect, covering about 2,230 ha, encompasses or adjoins the patented Pedmont prospect, Sorrels claim, and Rixy mine. The Rix prospect also encompasses or is adjoined by unpatented prospects--Hidden Gulch prospect, North Lime Peak prospect, Cole Creek mine, Lime Peak prospect, Golden Star prospect, and Coralie prospect.

The Rix prospect is along a mineralized zone which is as wide as 3.2 km. The zone begins at Iron Dyke mine and trends southwest through Alder Creek and beyond Copper Cliff mine.

The most recent work was concentrated in upper Hole Gulch and at the head of Lime Point Creek where mineral occurrences were indicated by surface exposures, and by geochemical and geophysical surveys. The diamond drill holes, totaling 1,329 m, in this area intersected volcanic rock containing as much as 20 percent pyrite, chalcopyrite, and covellite.

The prospect area has also been explored by numerous adits, prospect pits, and trenches. However, only workings which expose, or are indicated by dump material to be on, mineral occurrences were sampled.

The data obtained during the USBM examinations of the seven adits and nine caved adits, totaling about 610 m, 18 prospect pits, and 18 trenches is summarized in table A-5. Mineralized areas on the encompassed or adjoining prospects are described elsewhere.

SAMPLING. At the Rix prospect a total of 98 samples were taken, 47 in

1975 and one in 1992. Thirteen were chip samples across mineralized lenses and fractures as thick as 30 m. These samples contained as much as trace gold, 223 g/t (6.5 oz/ton) silver, and 5.5 percent copper. Another five chip samples were from across veins as thick as 0.9 m. These assayed as much as 31 g/t (0.9 oz/ton) gold, 34 g/t (1 oz/ton) silver, and 0.33 percent copper.

A additional fourteen chip samples were taken across mineralized lenses and fractures, as thick as 12 m, on claims adjoining or within the area covered by the Nix claims. These 14 samples contained as much as 11 g/t (0.32 oz/ton) silver and 2.4 percent copper. A further 16 chip samples from veins, as thick as 0.9 m, on the other claims had as much as trace gold, 185 g/t (5.4 oz/ton) silver, and 1.6 percent copper.

CONCLUSIONS: No resources are apparent at the Nix prospect. However, the number and wide distribution of lenses mineralized with copper and silver, the considerable amount of pyrite with copper-bearing minerals intersected by drilling, and the large zones of sulfide concentration indicated by geophysical prospecting suggest that subsurface exploration would likely disclose resources. Twelve working sites most likely to have resources are nos. 1, 2, 4-8, 10, 11, 15, 16, and 21) (fig. A-5, table A-5).

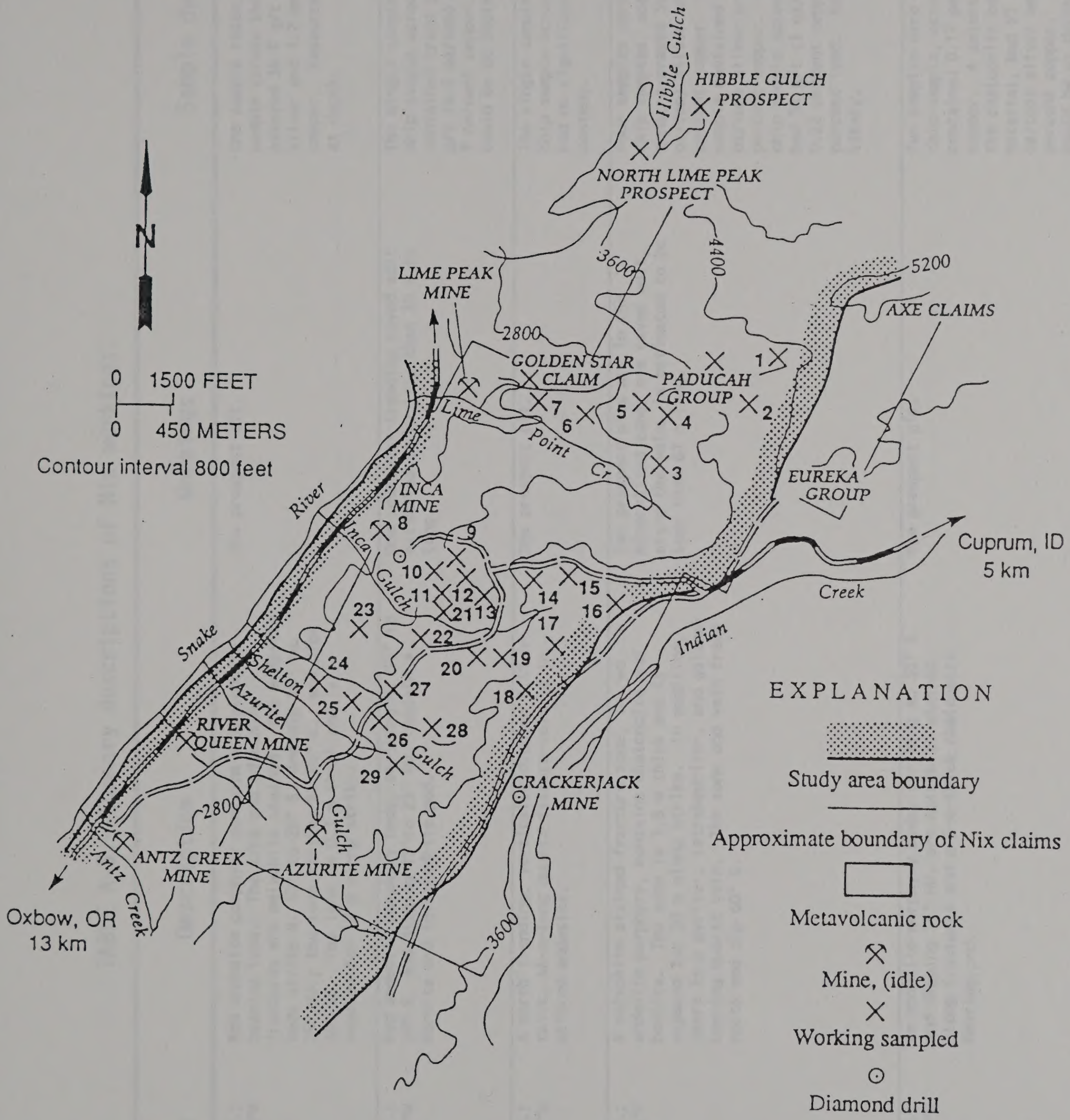

N
0 1500 FEET
0 450 METERS
Contour interval 800 feet
Hibble Gulch
HIBBLE GULCH PROSPECT
NORTH LIME PEAK PROSPECT
3600
4400
5200
AXE CLAIMS
LIME PEAK MINE
2800
GOLDEN STAR CLAIM
PADUCAH GROUP
1
2
3
4
5
6
7
Lime Point Cr
EUREKA GROUP
INCA MINE
8
9
River
Inca Gulch
10
11
12
13
21
14
15
16
17
Cuprum, ID
5 km
Creek
Indian
23
22
20
19
Snake
24
Shelton
Azurite
25
27
18
RIVER QUEEN MINE
26
Gulch
28
29
CRACKERJACK MINE
2800
Gulch
ANTZ CREEK MINE
AZURITE MINE
Antz Creek
Oxbow, OR
13 km
3600
EXPLANATION
Study area boundary
Approximate boundary of Nix claims
Metavolcanic rock
Mine, (idle)
Working sampled
Diamond drill

Figure A-5.- Nix prospect

TABLE A-5.--Summary descriptions of Nix workings.

(fig. A-5, no.)	Location	Description	Workings	Sample data
1	lat 45°05′06″N.; long 116°45′06″W	Red andesite porphyry contains a chalcocite-bearing lens. The lens and adjoining fractures are malachite stained. The andesite beds strike N. 10° to 20° E. and dip 15° to 25° NW.; the lens strikes N. 80° E., and dips 60° SE. The lens is 0.3 m thick and is exposed for 12 m along strike.	One prospect pit.	One sample taken, a chip sample across the lens, assayed 30.9 g/t (0.9 oz/ton) silver and 1.2 percent copper. Resources could be at depth.
2	lat 45°04′48″N.; long 116°45′09″W	Red andesite porphyry beds, striking N. 10° to 20° E. and dipping 15°to 25° NW, contain a bornite and tetrahedrite pod.	One southeast-trending caved adit estimated to be less than 30 m ft long.	The single sample taken, a chip sample across the pod, contained trace gold, 222.9 g/t (6.5 oz/ton) silver, and 3 percent copper. Resources could be at depth.
3	lat 45°04′31″N.; long 116°45′31″W	A north-trending, vertically-dipping 0.45-m-thick, 46-m-long quartz fissure-vein is in altered andesite.	One prospect pit.	The single sample taken, a chip sample across the vein, had no significant metal content.
4	lat 45°04′48″N.; long 116°45′26″W	A malachite stained fracture zone, in red andesite porphyry, contains chalcocite and bornite. The zone is 1.8 m thick and is exposed for 30 m along strike. In addition, there is a pyrite-, tetrahedrite-, and galena-bearing quartz vein. The zone and vein trend north and dip 60° E.	Two prospect pits are in the mineralized zone; one caved adit, along the vein, is estimated to be less than 61 m long.	Four samples were taken. Two chip samples, across the zone, averaged 34 g/t (1 oz/ton) silver and 2.6 percent copper. A select sample contained 93 g/t (2.7 oz/ton) silver and 5.5 percent copper. A 0.3-m-long chip sample across the vein had 31 g/t (1 oz/ton) gold, 0.22 percent copper, and 0.5 percent lead. Resources are likely.
5	lat 45°04′45″N.; long 116°45′38″W	In andesite porphyry beds, striking N. 35° E. and dipping 35° NW, are malachite stained along fractures and a 3-m-thick chalcocite bearing pod.	One prospect pit.	Two samples were taken. A chip sample, across the pod, contained 0.17 percent copper. A select sample, of the chalcocite bearing material, had 93 g/t (2.7 oz/ton) silver and 5.5 percent copper. Resources could be at depth.

TABLE A-5.--Summary descriptions of Nix workings-continued.

(fig. A-5, no.)	Location	Description	Workings	Sample data
6	lat 45°04′42″N.; long 116°45′57″W	A 0.8 m thick malachite-stained lens of chalcocite-bearing red andesite porphyry strikes N. 10° to 20° E. and dips 20° NW. The lens is exposed for about 46 m along strike.	One prospect pit.	One sample taken, a chip across the lens, assayed 82 g/t (2.4 oz/ton) silver and 2.1 percent copper. Resources are likely.
7	lat 45°04′41″N.; long 116°46′13″W	No mineralized structure is exposed. Dump material indicates red andesite porphyry, containing chalcocite, is malachite stained along fractures.	One prospect pit.	Two samples were taken. One chip sample, of andesite wallrock, assayed 0.087 percent copper. One select sample, of mineralized material from the dump, had 134 g/t (3.9 oz/ton) silver and 1.9 percent copper. Resources could be at depth.
8	lat 45°04′04″N.; long 116°47′00″W	No mineralized structure is exposed. Material on the dumps is indicative of a quartz-calcite vein as thick as 0.2 m. Vein material on the dumps contains limonite, malachite, azurite chalcopyrite, and chalcocite.	One prospect pit and three caved adits, estimated to total less than 122 m in length, were dug along a N. 60° E. trend for about 91 m.	Three grab samples were taken. The first, of vein material from the dump of the east adit, assayed 10 g/t (0.3 oz/ton) gold, 117 g/t (3.4 oz/ton) silver, 0.25 percent copper, and 1.6 percent zinc. The second, of vein material from the dump of the middle adit, contained 0.3 g/t (0.01 oz/ton) gold, 24 g/t (0.7 oz/ton) silver, 1.6 percent copper, and 0.056 percent zinc. The third, of vein material from the dump of the west adit, assayed 0.006 percent copper. Resources are likely.
9	lat 45°04′04″N.; long 116°46′36″W	No mineralized structure is exposed. Dump material is indicative of silicified, limonite stained andesite, with quartz-calcite fracture fillings.	One southeast-trending caved adit estimated to be less than 31 m long.	A grab of adit dump material had trace gold.

TABLE A-5.--Summary descriptions of Nix workings-continued.

(fig. A-5, no.)	Location	Description	Workings	Sample data
10	lat 45°03′59″N.; long 116°46′40″W	A 1.2-m-thick lens of sulfide bearing andesite is exposed for 9 m.	One prospect pit.	The two samples taken, chips across the lens, averaged 24 g/t (0.7 oz/ton) silver and 2.8 percent copper. Resources could be at depth.
11	lat 45°04′00″N.; long 116°46′41″W	No mineralized structure is exposed. Dump material suggests malachite-coated andesite is a depth.	One prospect pit.	A select sample, of malachite-coated dump material, had trace gold, 24 g/t (0.7 oz/ton) silver and 1.3 percent copper. Resources could be at depth.
12	lat 45°03′59″N.; long 116°46′35″W	No mineralized structure is exposed; dump material suggests altered andesite, limonite-stained along fractures, is a depth.	One trench.	A sample grab, from the dump, contained trace gold and 10 g/t (0.3 oz/ton) silver.
13	lat 45°03′51″N.; long 116°46′31″W	No mineralized structure is exposed; dump material suggests malachite-coated andesite, is at depth.	One trench.	The sample taken, selected of malachite-coated material from the dump, assayed 2.8 percent copper and 0.008 percent zinc.
14	lat 45°03′58″N.; long 116°46′12″W	Altered andesite porphyry is malachite-coated along fractures.	Two pits.	Two samples were taken. A 6.1-m-long chip, of malachite-coated andesite, contained 10 g/t (0.3 oz/ton) silver and 0.33 percent copper. A grab, of heavily malachite-stained dump material, assayed 17 g/t (0.5 oz/ton) silver and 0.73 percent copper.
15	lat 45°03′58″N.; long 116°46′05″W	A northeast-trending, malachite-coated, chalcocite-bornite-bearing lens, as thick as 0.1 m, is in altered red andesite porphyry. Also, malachite stains fractures for 1.2 m on either side of the lens.	One trench.	Two samples were taken; a chip across the lens had 3.4 g/t (0.1 oz/ton) silver and 0.79 percent copper; a select sample, of sulfide-bearing lens, assayed 17 g/t (0.5 oz/ton) silver and 4.6 percent copper. Resources could be at depth.

TABLE A-5.--Summary descriptions of Nix workings-continued.

(fig. A-5, no.)	Location	Description	Workings	Sample data
16	lat 45°03′50″N.; long 116°45′31″W	A zone, of quartz-calcite stringers, and malachite, chalcocite, bornite, and tetrahedrite lenses, is in silicified andesite trending northeast and dipping northwest. The stringers and lenses are as thick as 0.3 m; the zone is 12 m thick and exposed along strike for 46 m.	One trench and one southeast-trending caved adit estimated to be less than 31 m long.	Three samples were taken. A 12-long chip sample, across the zone, contained traces of gold and silver and 0.1 percent copper. A chip sample, across a 0.6-m-thick lens within the zone, assayed trace gold, 45 g/t (1.3 oz/ton) silver, and 2.3 percent copper. A grab sample, of vein material from the dump of the caved adit, had trace gold, 45 g/t (1.3 oz/ton) silver, and 1 percent copper. Resources could be at depth.
17	lat 45°03′40″N.; long 116°45′54″W	A quartz vein, as thick as 0.3 m, strikes N. 10° W. and dips 15° NE. in andesite beds that strike N. 40° E. and dip 30° NW. The vein, containing chalcocite, tetrahedrite, and bornite pods, is stained by malachite and azurite. It vein is exposed for 23 m along dip and 4.6 m along dip.	One trench.	Two samples were taken. A chip sample, across a sulfide-bearing part of the vein, had 14 g/t (0.4 oz/ton) gold, 185 g/t (5.4 oz/ton) silver, and 0.71 percent copper. Another chip sample, across the vein, had 0.7 g/t (0.02 oz/ton) gold, 10 g/t (0.3 oz/ton) silver, and 0.007 percent copper.
18	lat 45°03′32″N.; long 116°45′53″W	No mineralized structure is exposed. Dump material is indicative of a limonite- and malachite-stained quartz vein in andesite.	One prospect pit.	The sample, a grab of quartz from the dump, assayed 0.7 g/t (0.02 oz/ton) gold and 0.001 percent copper.
19	lat 45°03′37″N.; long 116°45′53″W	No mineralized structure is exposed. Dump material is indicative of a limonite- and tetrahedrite-bearing quartz veinlets, in andesite.	One prospect pit.	One grab sample, of sulfide-bearing quartz from the dump, assayed 2.7 g/t (0.08 oz/ton) gold, 45 g/t (1.3 oz/ton) silver and 0.006 percent copper.

TABLE A-5.--Summary descriptions of Nix workings-continued.

(fig. A-5, no.)	Location	Description	Workings	Sample data
20	lat 45°03′39″N.; long 116°46′26″W	Present is limonite- and malachite-stained andesite.	One trench.	The sample taken, a 35-m-long chip from along the trench, had 3.4 g/t (0.1 oz/ton) silver and 0.001 percent copper.
21	lat 45°03′45″N.; long 116°46′39″W	In red andesite porphyry is a N. 40° E. striking, 40° NW. dipping, 0.9-m-thick, malachite-coated, chalcocite-bearing lens. Malachite coats fractures on both sides of the lens.	A caved adit less than 31 m long.	A chip sample, taken across the lens during the previous study, assayed 10 g/t (0.3 oz/ton) silver and 0.6 percent copper. Another chip sample, taken across the lens in 1992 (R113, appendix C), had 25 ppb gold and 230 ppm copper. Resources could be at depth.
22	lat 45°03′41″N.; long 116°46′51″W	A 0.5-m-thick, limonite-stained zone strikes N. 9° E. and dips 60° SE. in andesite.	One 22-m-long, S. 72° E. trending adit.	The two samples taken, chips across the zone, averaged 3.4 g/t (0.1 oz/ton) silver, 0.04 percent copper, and 0.03 percent zinc.
23	lat 45°03′45″N.; long 116°47′06″W	A 3-m-thick, northeast-trending, 35° SE. dipping, rhyolite dike cuts andesite. Fractures along the dike are malachite stained.	One prospect pit.	The sample taken, a chip across the dike, contained 3.4 g/t (0.1 oz/ton) silver and 0.007 percent copper.
24	lat 45°03′25″N., long 116°46′26″W	No mineralized structure is evident in the altered andesitic-and sedimentary rocks.	One trench.	The sample taken, a 27-m-long chip along the trench, had trace silver and 0.008 percent zinc.
25	lat 45°03′19″N.; long 116°47′17″W	Limonite-stained andesite and rhyolite contain disseminated pyrite.	Two trenches.	The two samples taken, grabs from the trenches, averaged trace silver and 0.01 percent zinc.
26	lat 45°03′18″N.; long 116°47′08″W	No mineralized structure is exposed. Material on the dump is indicative of a quartz vein in andesitic rock.	One pit.	The sample taken, a grab from the dump, assayed trace silver.

TABLE A-5.--Summary descriptions of Nix workings-continued.

(fig. A-5, no.)	Location	Description	Workings	Sample data
27	lat 45°03′16"N.; long 116°47′01"W	A N. 60° W. striking, 35° NE. dipping, 0.9-m-thick shear zone is in northeast-trending, northwest-dipping, beds of altered andesite.	One prospect pit and one 9-m-deep decline.	The sample taken, a chip across the shear zone, contained trace gold, 14 g/t (0.4 oz/ton) silver, and 0.008 percent copper.
28	lat 45°02′42"N.; long 116°46′31"W	Altered andesite is limonite-stained along fractures.	One trench.	The sample taken, a 3-m-long chip along the trench, contained 0.01 percent zinc.
29	lat 45°02′54"N.; long 116°46′38"W	A zone of silicified, limonite-stained, sulfide-bearing, red andesite porphyry trends northeast and dip northwest. Along the zone is a 0.3-m-thick quartz vein.	One trench, one pit, and one east-trending caved adit estimated to be about 61 m long.	Three samples were taken. A grab sample, of limonite-stained andesite from the dump of the adit, contained 6.9 g/t (0.2 oz/ton) silver and 0.001 percent copper. A chip sample, across the vein, assayed 10 g/t (0.3 oz/ton) silver and 0.002 percent copper. A chip sample, of sulfide-bearing rock from along the 31-m-long trench, had 0.34 g/t (0.01 oz/ton) gold, 55 g/t (1.6 oz/ton) silver, and 0.007 percent copper.

NAME: North Lime Peak prospect (copper, gold, silver)

INDEX MAP NO.: Fig. 2, no. 12

LOCATION: SE. 1/4 sec. 1, T. 20 N., R. 4 W.; lat 45°05′46"N., long 116°45′42"W.; in the gully north of the Lime Peak mine.

ELEVATION: 1,130 m

ACCESS: By road 14 km north from Oxbow, then cross-country 2.4 km east.

GEOLOGY OF DEPOSIT: Leached, limonite-stained, massively bedded, red andesite porphyry, striking N. 10° to 20° E. and dipping 15° to 25° NW., contains volcanogenic lenses with malachite-stained quartz.

WORKINGS: One caved adit and two prospect pits constitute the workings. Pit no. 1 exposes a 0.4-m-thick lens striking N. 55° W. and dipping 30° NE. The lens is exposed for about 3 m along strike and contains malachite-bearing, breccia, and a 0.2-m-thick, 2.4-m-long, quartz stringer. Malachite occurs along fractures and bedding for 1.5 m on either side of the lens.

The caved adit, S. 22° W., 270 m horizontally from pit no. 1, extends for about 46 m along a bearing of N. 10° W. This adit appears to have been driven to intersect the lens exposed in pit no. 1 at depth. Only andesite is on the adit dump.

Pit no. 2 is between the caved adit and Lime Peak. It is sloughed, the dump is composed only of red andesite.

SAMPLING: A chip sample across the lens contained trace gold, 3.4 g/t (0.1 oz/ton) silver, and 0.096 percent copper. A grab sample, of malachite stained material from the dump, assayed 0.7 g/t (0.02 oz/ton) gold, 7 g/t (0.2 oz/ton) silver, and 1.7 percent copper. The caved adit and pit no. 2 dump samples each assayed 0.01 percent copper.

CONCLUSIONS: While too small to be classified a resource, the lens is along the trend of the Lime Peak zone; deposits similar to those at the Lime Peak mine may be disclosed by exploration.

NAME: Paducah prospect (gold)

INDEX MAP NO.: Fig. 2, no. 9

LOCATION: Center sec. 7, T. 20 N., R. 3 W.; lat 45°05′20"N., long 116°45′15"W.; about 3 km east of Hells Canyon Reservoir.

ELEVATION: 1,100 m

ACCESS: By road 6.4 km southwest from Cuprum then cross country 1.6 km.

HISTORY: Located in 1901 and patented in 1907, the two lode claims of the Paducah group cover 12.6 ha (MS-2284).

GEOLOGY OF DEPOSIT: The prospect is underlain by red andesite beds striking N. 10° to 20° E. and dipping 15° to 25° NW. The rocks contain a limonite-stained, 0.4-m-thick, 110-m-long quartz vein, which strikes N. 30° E., dips 55° to 70° SE., and contains disseminated pyrite.

WORKINGS: There are two prospect pits.

SAMPLING: Three chip samples from across the vein assayed as much as 1.4 g/t (0.04 oz/ton) gold, and averaged 0.5 g/t (0.015 oz/ton).

CONCLUSIONS: The vein is too small and low grade to be classified a resource, however, a mineral resource may exist.

NAME: Panama Pacific (Victoria) prospect (copper, gold, silver)

INDEX MAP NO.: Fig. 2, no. 34

LOCATION: NE. 1/4 sec. 12, T. 21 N., R. 3 W.; lat 45°10′28"N., long 116°38′23"W.; on the south side of Deep Creek.

ELEVATION: 2,070 m

ACCESS: By road 14 km north from Cuprum, then cross country 1.2 km east.

GEOLOGY OF DEPOSIT: At the prospect is a northwest-trending system of joints in granodiorite. One joint is filled by a pegmatite dike of quartz, feldspar, muscovite, with bornite-chalcopyrite pods. The latter, are as much as 2.5 cm in diameter; they occur mainly in quartz-rich portions of the dike, and are usually coated by malachite.

WORKINGS: A 12-m-deep, water-filled, decline is on the pegmatite dike. The dike strikes N. 80° W., dips 30° SW., and is 0.15 m thick at the shaft collar. It reportedly swells to 0.4 m thick in the shaft (Livingston and Laney, 1920, p. 38).

SAMPLING: Three chip samples from across the pegmatite dike assayed as much as 0.3 g/t (0.01 oz/ton) gold, 20.6 g/t (0.6 oz/ton) silver, 1.5 percent copper; they averaged trace gold, 7 g/t (0.2 oz/ton) silver, and 0.7 percent copper.

CONCLUSIONS: There is the potential for the discovery of resources.

NAME: Peacock mine (copper, silver)

INDEX MAP NO.: Fig. 2, no. 36

LOCATION: SW. 1/4 sec. 12, T. 21 N., R. 3 W.; lat 45°10′09"N., long 116°39′00"W.; near the head of Copper Creek.

ELEVATION: 2,030 m

ACCESS: By road 13 km northerly from Cuprum.

HISTORY: The Peacock, covering 8 ha, was located as a placer claim in the 1870′s (Lot-37). Four lode claims and two placer, surrounding the Peacock and adjoining South Peacock mine, were located and patented later (MS 942, 1352, 1430, 1520, 1521, 1555). The Peacock mine operated intermittently from the 1870′s to the 1960′s. Most mining was done between 1883 and 1910, and between 1960 and 1968.

PRODUCTION: Production from the Peacock and nearby mines, between 1883 and 1968, totaled 36,162 t (39,861 short tons) of ore that yielded 57,665 g (1,854 oz) of gold, 6,695,761 g (215,277 oz) of silver, and 5,392,412 kg copper (Close and others, 1976). The ore graded 1.6 g/t (0.046 oz/ton) gold, 185.2 g/t (5.4 oz/ton) silver, and 149.1 kg/t (15 percent) copper all worth about $47.83/t ($53 per short ton) at the times of production.

GEOLOGY OF DEPOSIT: The mine is on a northeast-dipping, discontinuous, contact replacement (tactite) zone between limestone and granodiorite (figs. A-6 and A-7). The zone is irregularly shaped and mineralized mainly along fractures. The important metallic minerals--bornite, chalcopyrite, and chalcocite, occur in lenses and disseminations heavily coated by malachite, azurite, and chrysocolla. Gangue minerals include garnet, quartz, calcite, pyrite, specularite, and epidote. Drilling indicates copper-bearing minerals also occur in surrounding granodiorite.

WORKINGS: Old company maps show two adits, totaling 610 m, two shafts, stopes, drifts and crosscuts, diamond and rotary drill holes, and dozer trenches. Entrances to nearly all workings have been dozed and are not recognizable, neither are the locations of most drill holes.

The principal adit is open for 24 m; early production probably came from stopes in it. The main shaft, reportedly 46 m deep, was sunk in tactite near the face of the adit. Latest work, the drilling of 49 rotary and 9 diamond drill holes, as well as extensive dozer trenching, was done by a lessee in the 1960′s. Data are available for only five of the holes.

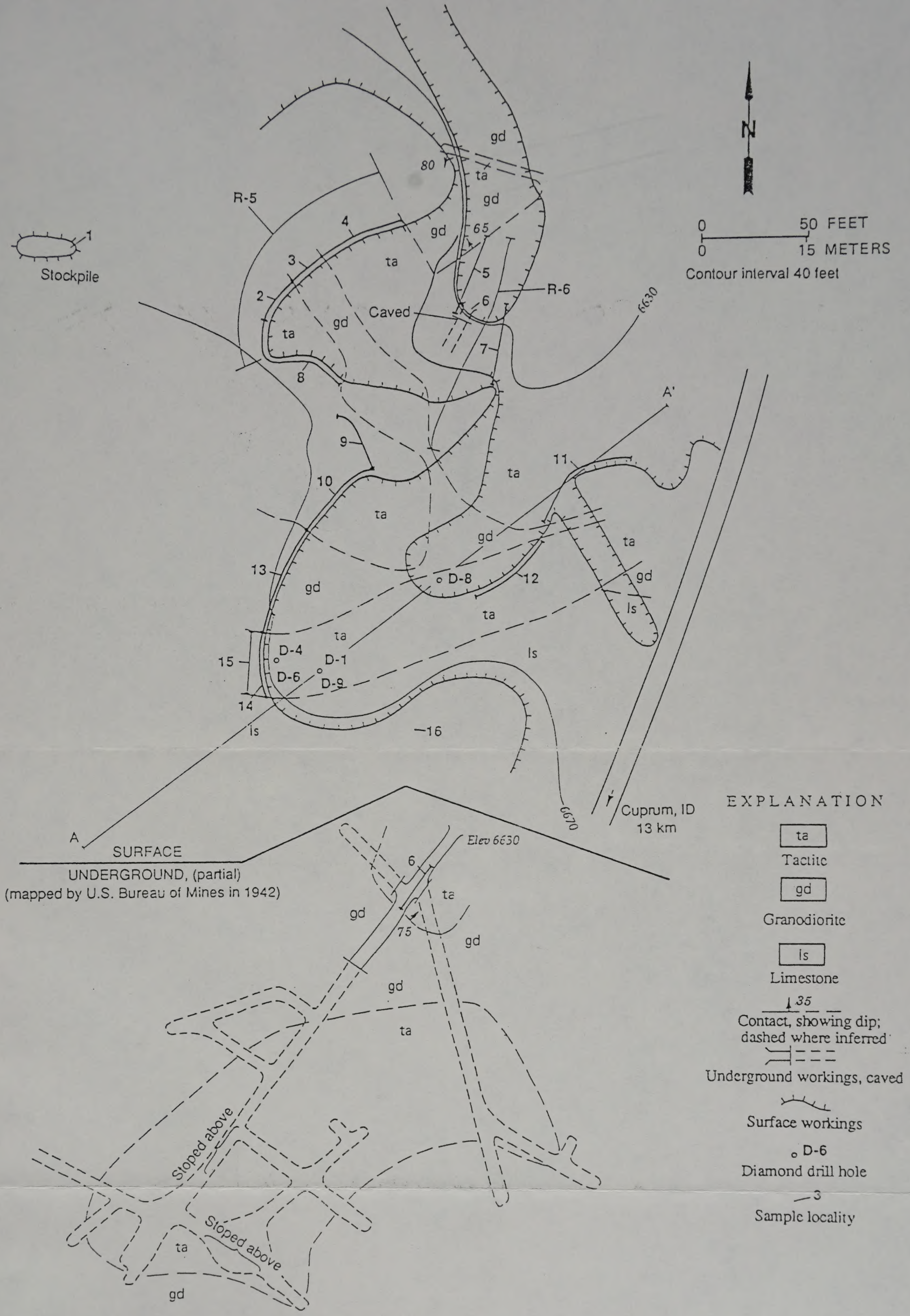
SAMPLING: Data for sixteen samples, taken at the Peacock mine during the previous USBM study, along with data for two additional samples taken in 1992 (nos. R5 and R6), are shown on fig. A-6 and in table A-6. Additional data for samples R5 and R6 are listed in appendix C.

RESOURCE ESTIMATE: The Peacock tactite deposit is exposed for 69 m (225 feet) in a northeasterly direction, for 61 m (200 feet) in a northwesterly direction, and according to drill logs extends to a depth of at least 36 m (120 feet). Based on these dimensions and the USBM

sampling, the tactite contains at least 400,000 t (440,000 tons) of resources grading 0.17 g/t (0.005 oz/ton) gold, 24 g/t (0.7 oz/ton) silver, and 1.35 percent copper.

CONCLUSIONS: Mining of the Peacock was inhibited by the small size of the ore bodies and by the inability to make concentrates from the lower-grade material. Because the ore was heavily oxidized and metallurgically complex, it required handsorting for direct shipment to a smelter. Remoteness of the deposit and resultant high transportation costs made rock containing less than 10 percent copper uneconomic; therefore, high-cost, selective mining methods had to be used. In most cases, lessees used little planning or exploration preceding mining. Much material, high grade by today's standards, was left behind. In recent years, methods for treating the ore have been developed, making concentration possible. This, combined with the improved access, may make the Peacock deposit minable. The tactite has been explored and its limits defined, but exploration in the surrounding granodiorite could disclose additional resources.

If the resource at the Peacock mine was to be mined, it would probably be done so in conjunction with resources at the nearby South Peacock mine. Based on USBM economic analyses of similar-size resources, mining of shallow tactites of about 2 million t (2.2 million short tons) could break even at a recoverable mineral value of about $28/t ($31 per short ton).


N
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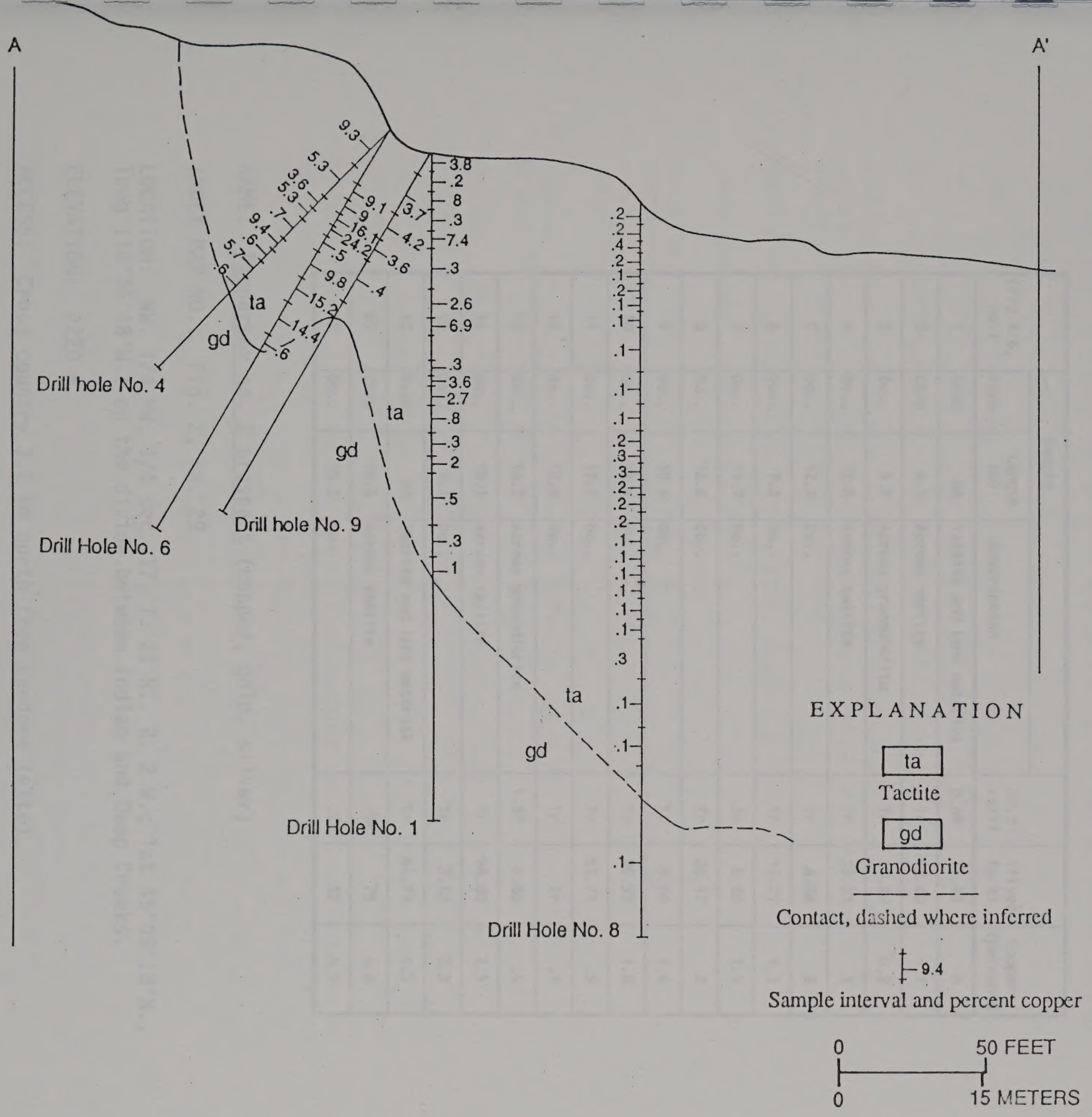
0 15 METERS
Contour interval 40 feet
Stockpile
1
R-5
R-6
Caved
gd
ta
ls
80
65
75
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
A
A'
D-1
D-4
D-6
D-8
D-9
6630
6670
Cuprum, ID
13 km
SURFACE
UNDERGROUND, (partial)
(mapped by U.S. Bureau of Mines in 1942)
Elev 6630
Stoped above
Stoped above
EXPLANATION
ta
Tactite
gd
Granodiorite
ls
Limestone
35
Contact, showing dip; dashed where inferred
Underground workings, caved
Surface workings
D-6
Diamond drill hole
3
Sample locality

Figure A-6.- Peacock mine


A
A'
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5.3
3.6
5.3
.7
9.4
.6
5.7
.6
9.1
.9
16.
24.2
.5
9.8
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ta
gd
ta
gd
ta
gd
Drill hole No. 4
Drill Hole No. 6
Drill hole No. 9
Drill Hole No. 1
Drill Hole No. 8
EXPLANATION
ta
Tactite
gd
Granodiorite
Contact, dashed where inferred
9.4
Sample interval and percent copper
0
50 FEET
0
15 METERS

Figure A-7.- Peacock mine, idealized cross section

TABLE A-6.--Descriptions and analyses of samples from the Peacock mine.

[m, meter; g/t, gram per metric ton; Tr, trace; NA, not applicable; sample nos. 1-16 were taken in 1974 and nos. R5 and R6 in 1992.]

	Sample					
(fig A-6, no.)	Type	Length (m)	Description	Gold (g/t)	Silver (g/t)	Copper (percent)
1	Grab	NA	Tactite and lens material	0.69	75.43	6
2	Chip	6.1	Across tactite	Tr	48.00	4.1
3	Do..	5.5	Across granodiorite	Tr	10.29	0.2
4	Do..	12.8	Across tactite	Tr	13.71	1
5	Do..	12.2	Do..	Tr	6.86	2
6	Do..	7.3	Do..	Tr	13.71	1.1
7	Do..	11.9	Do..	.34	6.86	1.5
8	Do..	16.8	Do..	Tr	20.57	2
9	Do..	10.4	Do..	Tr	6.86	1.4
10	Do..	13.4	Do..	Tr	20.57	1.8
11	Do..	17.7	Do..	Tr	61.71	.5
12	Do..	12.8	Do..	Tr	Tr	.1
13	Do..	16.2	Across granodiorite	1.37	6.86	.4
14	Do..	10.1	Across tactite	Tr	96.00	2.5
15	Do..	9.1	Do..	Tr	3.43	2.3
16	Grab	NA	Tactite and lens material	Tr	61.71	4.3
R5	Chip	18.3	Across tactite	.54	75	6.6
R6	Do..	18.3	Do..	.33	32	6.9

NAME: Pepperbox no. 2 prospect (copper, gold, silver)

INDEX MAP NO.: Fig. 2, no. 29

LOCATION: NW. 1/4 NW. 1/4 sec. 17, T. 21 N., R. 2 W.; lat 45°09′18"N., long 116°36′48"W.; on the divide between Indian and Deep Creeks.

ELEVATION: 2220 m

ACCESS: Cross country 3.2 km north from Landore (site).

HISTORY: Records indicate the prospect was patented, but no details are available.

GEOLOGY OF DEPOSIT: At the prospect is a northwest-trending, 70-m-long, 24-m-wide, tactite zone between granodiorite and limestone. The limestone trends N. 5° to 40° E. and dips 10° to 60° NW. Within the tactite the limestone has been replaced by garnet, quartz, and epidote. In one location, near the western end of the zone, are malachite-coated bornite stringers.
WORKINGS: There are three small prospect trenches.

SAMPLING: A 7.6-m-long chip sample, from across the western end of the zone, contained trace gold and silver, and 0.35 percent copper. Four chip samples, from the middle and eastern ends of the zone, had as much as trace gold and silver and 0.004 percent copper.

CONCLUSIONS: The copper-bearing part of the tactite covers about 8 square meters, too small to be classified a resource. However, a potential exists for mineral resources.

NAME: Red Ledge prospect (gold, zinc, copper, silver)

INDEX MAP NO.: Fig. 2, no. 39

LOCATION: Secs. 22-26, T. 22 N., R. 3 W.; lat 45°13′44"N., long 116°40′05"W.; on Deep Creek about 3 km upstream from the Snake River.

ELEVATION: 840 m

ACCESS: By road 46 km north from Oxbow to Eagle Bar then by poorly maintained road 8 km east (fig. A-8 and A-9).

HISTORY: The prospect consists of 41 patented lode, placer, and millsite claims covering about 332 ha (MS-3005--3007). Livingston and Laney (1920, p. 44) and various USBM visitors to the prospect reported that, the prominent iron-stained rhyolite at the prospect was noted by the area's first settlers, but not claimed until the 1880's when located by Thomas Heady. He held the claims until 1915, when he sold them to R. N. Bell, who did underground and surface exploration. S. W. Mudd bought the prospect from Bell in 1918; he and his associates drilled 30 diamond core holes. The holes outlined copper-zinc deposits. An additional 23 holes were drilled by George G. Rice in 1926 and 1927. In 1932, Coolie Butler acquired the prospect and drilled 30 holes. He also built a camp at Eagle Bar on the Snake River, constructed a narrow road to the prospect, and began a haulage tunnel from Eagle Bar (fig. A-8). In 1942, C. F. Tolman and Wallace Butler examined the prospect; they relogged and reassayed all drill cores.

Bear Creek Mining Company did surface exploration in the 1950's and 1960's. The American Smelting and Refining Company secured an option on the property in 1962; that company did some geological mapping and geophysical exploration. In 1963, Hecla Mining Company did additional geophysical exploration and geologic mapping. The company drilled four holes to test geophysical anomalies; two holes intersected mineralized zones. In 1970, American Standard, Incorporated, took an option on the

property. Seven holes were drilled from underground workings and two from surface sites. In the same year, Cities Service Minerals Corporation drilled three additional holes to test for the presence of a large, disseminated deposit.

In 1972, Birch Creek Resources, a subsidiary of Texasgulf, Incorporated, secured an option on the prospect, examined the drill cores, remapped the geology, and began drilling. By the winter of 1977, 11,000 m of drilling had been done. Texasgulf purchased the prospect in 1979.

PRODUCTION: No ore has been produced from the prospect.

GEOLOGY OF DEPOSIT: The Red Ledge prospect is a typical volcanogenic deposit. It is underlain by a dome-shaped, brecciated, rhyolitic intrusion; accompanying rhyolitic ash flows, tuff, and breccia are intercalated with andesitic-flows and -breccia (figs. A-9 and A-10). The rhyolite and surrounding andesite contain 3- to 46-m-thick, radiating, steeply-dipping, dacitic to andesitic dikes.

Massive sulfide lenses are along the irregular, brecciated, westerly contact between the rhyolite and overlapping andesite flows. In brecciated, iron- and malachite-stained rhyolite and andesite, the lenses consist of pyrite, chalcopyrite, chalcocite, bornite, and sphalerite, with sporadic galena; in quartz and barite.

Lens exposures are coated by limonite and malachite and are secondarily enriched to depths of about 61 m. The brecciated rhyolite surrounding, and east of the lenses, contains quartz veins and stringers, disseminated blebs and streaks of chalcopyrite, pyrite, sphalerite, galena, and tetrahedrite. The sulfide minerals have oxidized to jarosite and limonite near the surface of the rhyolite intrusion.

WORKINGS: Workings include two inter-connected adits, on the east side of Deep Creek, that have a total length of about 670 m (figs. A-9 and A-10); the caved Eagle Bar haulage tunnel, driven 240 m under the divide from the Snake River toward Deep Creek; and at least two exploration adits (fig. A-9, nos. 1 and 2). More than 70 diamond drill holes totaling over 23,000 m, have been drilled.

SAMPLING: In 1942 and 1974 the Bureau of Mines took a total of 55 chip samples from underground lens exposures (tables A-7 and A-8). A composite of samples (table A-8, no. 16) from the southwesterly crosscuts of the lower adit contained 39 g/t (1.1 oz/ton) silver, 0.77 percent copper, and 1.52 percent zinc. A composite of samples (table A-8, no. 15) taken 84 m from the portal of the lower adit assayed 115 g/t (3.4 oz/ton) silver, 0.95 percent copper, and 8.74 percent zinc. Samples taken 54 m from the portal of the upper adit (table A-8, no. 15, nos. 5-11, 13-14) averaged 147 g/t (4.2 oz/ton) silver, 1.47 percent copper, and 4.54 percent zinc.

RESOURCE ESTIMATE: Underground workings and pre 1962 diamond drilling outline two massive sulfide lens deposits on the northwest edge of the

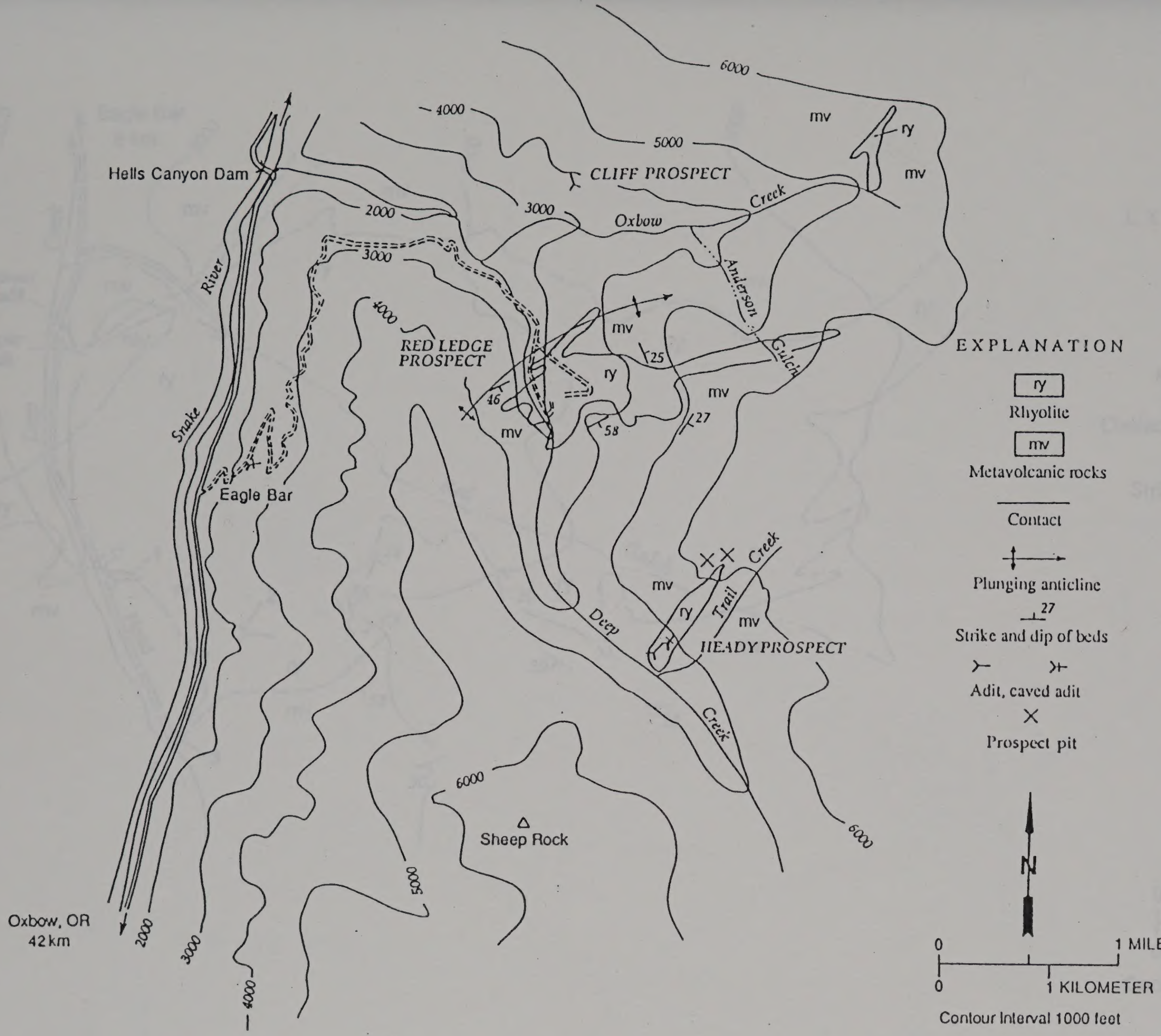

6000
4000
5000
mv
ry
mv
Hells Canyon Dam
CLIFF PROSPECT
Creek
3000
Oxbow
2000
3000
Anderson
River
4000
mv
RED LEDGE PROSPECT
25
Gulch
ry
mv
46
58
27
Snake
mv
Eagle Bar
mv
Creek
ry
Trail
mv
Deep
HEADY PROSPECT
Creek
6000
Sheep Rock
5000
6000
Oxbow, OR 42 km
2000
3000
4000
EXPLANATION
ry
Rhyolite
mv
Metavolcanic rocks
Contact
Plunging anticline
27
Strike and dip of beds
Adit, caved adit
Prospect pit
N
0
1 MILE
0
1 KILOMETER
Contour Interval 1000 feet

Figure A-8.- Red Ledge prospect and vicinity

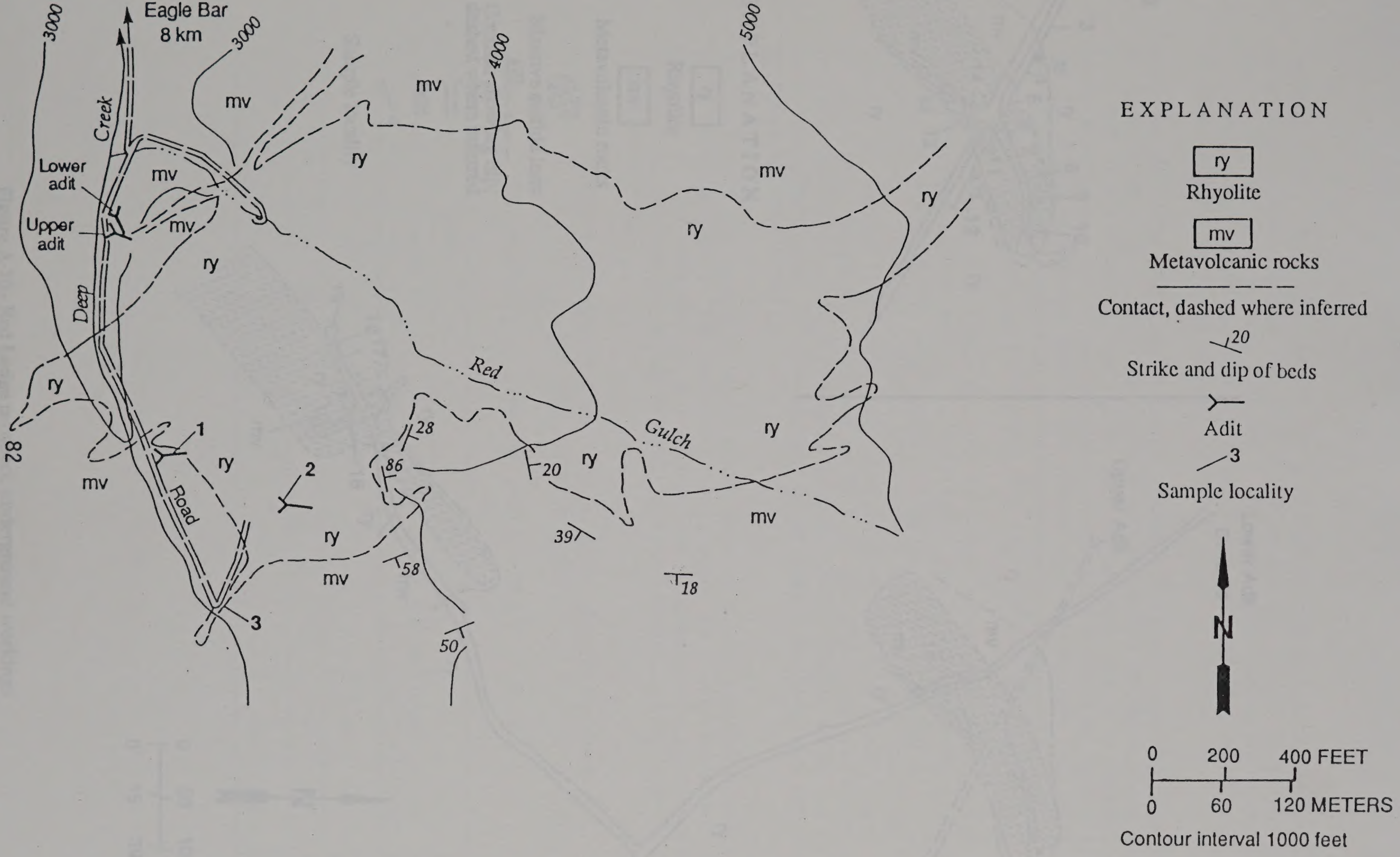

Eagle Bar
8 km
3000
3000
4000
5000
mv
ry
Creek
Deep
Lower adit
Upper adit
Red
Gulch
Road
1
2
3
28
86
20
39
58
18
50
EXPLANATION
ry
Rhyolite
mv
Metavolcanic rocks
Contact, dashed where inferred
20
Strike and dip of beds
Adit
3
Sample locality
N
0
200
400 FEET
0
60
120 METERS
Contour interval 1000 feet

Figure A-9.- Red Ledge prospect

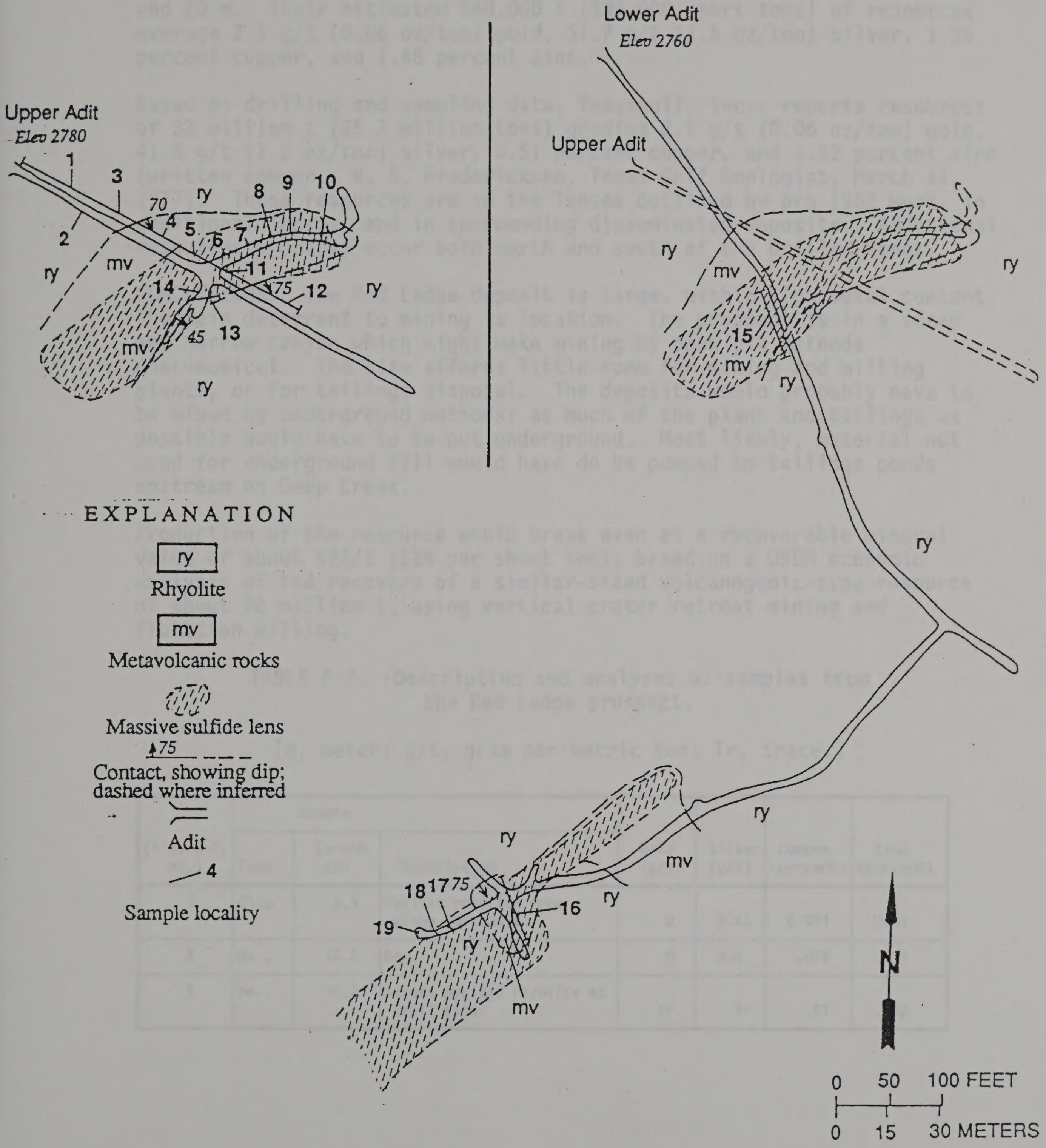

Upper Adit
Elev 2780
1
2
3
70
4
5
6
7
8
9
10
11
12
13
14
45
75
ry
mv
Lower Adit
Elev 2760
Upper Adit
15
16
17
18
19
75
EXPLANATION
ry
Rhyolite
mv
Metavolcanic rocks
Massive sulfide lens
75
Contact, showing dip; dashed where inferred
Adit
4
Sample locality
N
0 50 100 FEET
0 15 30 METERS

Figure A-10.- Red Ledge prospect, underground workings

contact zone. They are exposed by workings or are crosscut by drill holes over strike lengths of 88 and 116 m, and have average widths of 15 and 20 m. Their estimated 540,000 t (595,000 short tons) of resources average 2.1 g/t (0.06 oz/ton) gold, 51.7 g/t (1.5 oz/ton) silver, 1.36 percent copper, and 1.48 percent zinc.

Based on drilling and sampling data, Texasgulf, Inc., reports resources of 23 million t (25.3 million tons) grading 2.1 g/t (0.06 oz/ton) gold, 41.5 g/t (1.2 oz/ton) silver, 0.51 percent copper, and 1.32 percent zinc (written commun., R. S. Fredericksen, Texas Gulf Geologist, March 11, 1977). These resources are in the lenses outlined by pre 1962 work, in additional lenses, and in surrounding disseminated deposits. Additional resources probably occur both north and south of the drilled zones.

CONCLUSIONS: The Red Ledge deposit is large, with a high metal content. The main deterrent to mining is location. The prospect is in a steep and narrow canyon which might make mining by open pit methods uneconomical. The site affords little room for mining and milling plants, or for tailings disposal. The deposits would probably have to be mined by underground methods; as much of the plant and tailings as possible would have to be put underground. Most likely, material not used for underground fill would have do be pumped to tailings ponds upstream on Deep Creek.

Production of the resource would break even at a recoverable mineral value of about $22/t ($24 per short ton); based on a USBM economic analysis of the recovery of a similar-sized volcanogenic-type resource of about 20 million t, using vertical crater retreat mining and flotation milling.

TABLE A-7.--Description and analyses of samples from the Red Ledge prospect.

[m, meter; g/t, gram per metric ton; Tr, trace.]

	Sample						
(fig. A-9, no.)	Type	Length (m)	Description	Gold (g/t)	Silver (g/t)	Copper (percent)	Zinc (percent)
1	Chip	6.1	Pyritic rhyolite from along adit wall	0	3.43	0.091	0.01
2	Do..	12.2	Do..	0	3.4	.039	.015
3	Do..	15.2	Across pyritic rhyolite at drill site	Tr	Tr	.01	.002

TABLE A-8.--Description and analyses of samples from the Red Ledge prospect, underground workings.

[m, meter; g/t, gram per metric ton; Tr, trace; --, not determined.]

	Sample						
(fig. A-10, no.)	Type	Length (m)	Description	Gold (g/t)	Silver (g/t)	Copper (percent)	Zinc (percent)
1	Chip	21.3	Along wall	0.69	6.86	0.068	0.18
2	Do..	1.2	Across back	.7	6.9	.03	.073
3	Do..	13.7	Along wall	.34	0	.019	.075
4	Do..	13.1	Do..	Tr	3.43	.016	.033
5	Do..	6.7	Across part of north lens	.34	72.00	.15	.11
6	Do..	1.2	Do..	--	157.71	.07	.1
7	Do..	1.2	Do..	--	150.85	.25	.8
8	Do..	1.5	Do..	--	219.42	.57	.9
9	Do..	1.5	Do..	--	178.28	.68	1.3
10	Do..	1.5	Do..	--	147.43	1.87	2.7
11	Do..	14.3	Do..	2.40	305.14	2	.32
12	Do..	18.3	Along wall	0	27.43	Tr	.12
13	Do..	3.0	Across part of lens	--	17.14	.27	.5
14	Do..	7.6	Do..	Tr	61.71	1.3	.42
15[1]	Do..	15.2	Across north lens	--	115.20	.95	8.74
16[2]	Do..	15.2	Do..	--	38.74	.77	1.52
17	Do..	1.5	Do..	--	13.71	.32	.1
18	Do..	1.2	Do..	--	3.43	.23	.1
19	Do..	1.2	Across face	--	3.43	.28	.1

[1] Composite of 14 samples.
[2] Composite of 13 samples.

NAME: Ritchie Gulch prospect (copper, gold, silver)

INDEX MAP NO.: Fig. 2, no. 32

LOCATION: N. 1/2 SE. 1/4 sec. 7, T. 21 N., R. 2 W.; lat 45°10′00"N., long 116°37′10"W.; on the south side of Deep Creek.

ELEVATION: 1,980 m

ACCESS: North by road 8 km and then cross-country 4.8 km from Cuprum.

GEOLOGY OF DEPOSIT: A limestone xenolith, altered to tactite, is in granodiorite. The xenolith exposure, less than 4 m in diameter, is composed of garnet, quartz, and epidote; it contains small, scattered malachite- and azurite-coated pods.

WORKINGS: There are two prospect pits and a northwest-trending caved adit about 46 m long.

SAMPLING: A chip sample across the xenolith assayed trace gold and silver, and 2 percent copper. Two grab samples of tactite material from dumps averaged 0.07 percent copper.

CONCLUSIONS: The xenolith is small; however, a mineral resource potential is indicated.

NAME: River Queen mine (copper, silver, gold)

INDEX MAP NO: Fig. 2, no. 5

LOCATION: SE. 1/4 sec. 22, T. 20 N., R. 4 W.; lat 45°03′05"N., long 116°48′12"W.; about 0.5 km east of Hells Canyon Reservoir.

ELEVATION: 510 m

ACCESS: By road 10 km north from Oxbow.

HISTORY: The four claims comprising the River Queen mine, covering 31 ha (MS-1358 and 2127), were patented between 1899 and 1906.

PRODUCTION: Ore was first produced from the River Queen mine in 1912; sporadic production continued until 1955. The 523 t (576 short tons) of ore produced yielded 145 g (4.6 oz) of gold, 50,169 g (1,613 oz) of silver, and 76,107 kg of copper (Close and others, 1976). The ore graded 0.28 g/t (0.008 oz/ton) gold, 96 g/t (2.8 oz/ton) silver, and 145.6 kg/t (15 percent) copper, all worth about $64/t ($70 per short ton) at the times of production.

GEOLOGY OF DEPOSIT: The country rock is fractured andesite, tuff, and pyritic-rhyolite beds striking N. 70° W. and dipping 65° NE. (fig. A-11). The mineralized structure is copper-bearing lens striking about N. 80° E. and dipping steeply. The lens is composed of malachite-coated rhyolite with pyrite, chalcopyrite, and bornite. Heavy malachite staining and sulfides occur over a width of 4.6 m in the stoped areas.

WORKINGS: Connected by a stope are two adits with drifts; all totaling about 335 m.

SAMPLING: A total of 35 samples were taken at the River Queen mine in 1974; another sample (R21) was taken in 1992 (table A-9). Eight chip

samples (nos. 3, 4, 9, 12, 18, 22, 23, 24), across the lens had as much as 2.5 percent copper.

CONCLUSIONS: The lens averages 1.6 m thick, is exposed for 49 m along strike, for 30 m along dip, and is an small occurrence of at least 6,000 t (6,600 short tons) grading 1.7 percent copper. Exploration would probably disclose resources at depth.

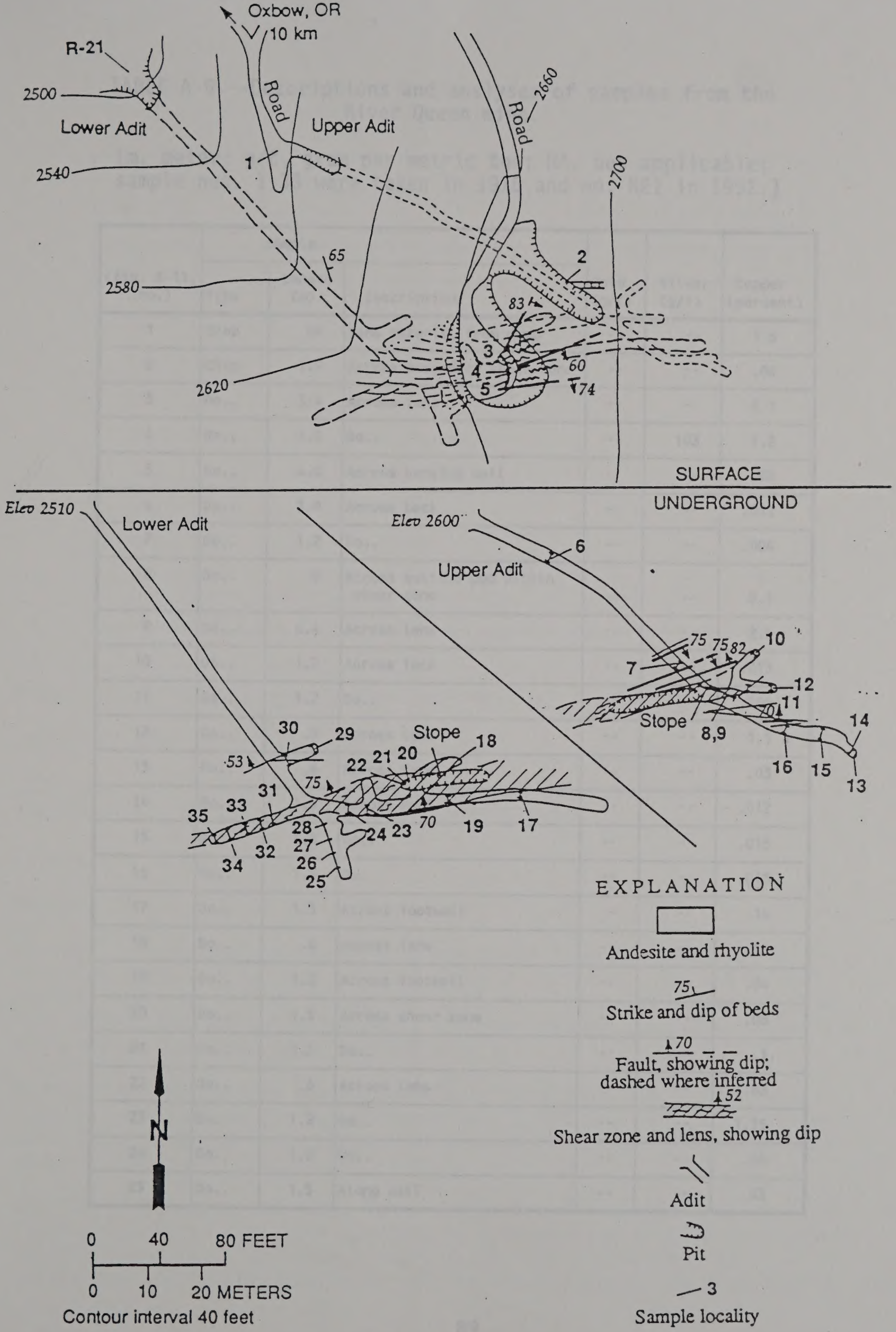

Oxbow, OR
10 km
R-21
2500
Lower Adit
2540
Road
Upper Adit
1
2580
65
2620
Road
2660
2700
2
83
3
4
5
60
74
SURFACE
UNDERGROUND
Elev 2510
Lower Adit
Elev 2600
Upper Adit
6
75
75
82
10
7
12
11
Stope
8,9
14
16
15
13
30
29
Stope
18
53
22
21
20
75
31
33
35
28
27
26
25
24
23
70
19
17
32
34
EXPLANATION
Andesite and rhyolite
75
Strike and dip of beds
70
Fault, showing dip; dashed where inferred
52
Shear zone and lens, showing dip
Adit
Pit
3
Sample locality
N
0
40
80 FEET
0
10
20 METERS
Contour interval 40 feet

Figure A-11.- River Queen mine

TABLE A-9.--Descriptions and analyses of samples from the River Queen mine.

[m, meter; g/t, gram per metric ton; NA, not applicable; sample nos. 1-35 were taken in 1975 and no. R21 in 1992.]

(fig. A-11, no.)	Sample			Gold (g/t)	Silver (g/t)	Copper (percent)
	Type	Length (m)	Description			
1	Grab	NA	Lens material from dump	--	--	1.6
2	Chip	1.9	Across secondary shear zone	--	--	.04
3	Do..	3.4	Across lens	--	--	2.1
4	Do..	1.2	Do..	--	103	1.2
5	Do..	4.0	Across hanging wall	--	--	.02
6	Do..	3.0	Across back	--	--	.012
7	Do..	1.2	Do..	--	--	.004
8	Do..	.9	Across sulfide pod within shear zone	--	--	8.5
9	Do..	6.4	Across lens	--	--	2.5
10	Do..	1.2	Across face	--	--	.013
11	Do..	1.2	Do..	--	--	.006
12	Do..	.9	Across lens	--	--	1.1
13	Do..	.6	Across face	--	--	.03
14	Do..	1.5	Across back	--	--	.012
15	Do..	1.8	Do..	--	--	.016
16	Do..	1.5	Do.	--	--	.018
17	Do..	1.5	Across footwall	--	--	.14
18	Do..	.6	Across lens	--	--	.16
19	Do..	1.2	Across footwall	--	--	.04
20	Do..	1.5	Across shear zone	--	--	.08
21	Do..	1.5	Do..	--	--	.1
22	Do..	.6	Across lens	--	--	1.83
23	Do..	1.2	Do..	--	--	1.15
24	Do..	1.2	Do..	--	--	.06
25	Do..	1.5	Along wall	--	--	.03

TABLE A-9.--Descriptions and analyses of samples from the River Queen mine-continued.

Sample						
(fig. A-11, no.)	Type	Length (m)	Description	Gold (g/t)	Silver (g/t)	Copper (percent)
26	Chip	1.8	Along wall	--	--	0.04
27	Do..	1.5	Do..	--	--	.74
28	Do..	1.5	Do..	--	--	.06
29	Do..	1.2	Across back	--	--	.1
30	Do..	.9	Do..	--	--	.61
31	Do..	1.1	Across shear zone	--	--	.03
32	Do..	1.2	Do..	--	--	.02
33	Do..	.9	Do..	--	--	.23
34	Do..	.9	Do..	--	--	.03
35	Do..	.9	Do..	--	--	.03
R21	Grab	NA	Massive sulfides from dump	0.08	5.4	4.7

NAME: South Peacock mine (copper, silver)

INDEX MAP NO.: Fig. 2, no. 35

LOCATION: SE. 1/4 sec. 12, T. 21 N., R. 3 W.; lat 45°10′00"N., long 116°38′54"W.; at the headwaters of Copper Creek.

ELEVATION: 2,048 to 2,109 m

ACCESS: By road 13 km north from Cuprum.

HISTORY: Discovered in the 1870′s, the South Peacock lode claim covering about 7.6 ha, was patented in 1891 (Lot-44). Two additional claims, covering another 15 ha, were patented later (MS-844 and M-1538). Most mining took place in the early 1900′s; however, sporadic mining and exploration continued into the 1970′s.

PRODUCTION: Production was included with that from the Peacock mine; however, at least 49,700 kg of copper and 51,940 g (1,670 oz) of silver were taken from the South Peacock mine between 1915 to 1960 (Close and others, 1976).

GEOLOGY OF DEPOSIT: The mine is on a contact replacement (tactite) in faulted blocks of limestone engulfed by granodiorite (fig. A-12). The tactite trends east and dips steeply south. It is composed of malachite- and azurite-coated garnet, epidote, specularite, and quartz.

Contained in it are pods and lenses of bornite, chalcocite, covellite, pyrite, and chalcopyrite.

WORKINGS: Underground workings consist of an adit and three shafts with drifts, stopes; they have an estimated combined length of more than 910 m. Surface workings include seven dozer trenches and two prospect pits. The western-most shaft, the only one accessible, is in the main tactite zone. Its collar is caved, but the shaft can be entered from an adit 30 m east. The shaft is 99 m deep but is filled with water below 76 m. Crosscuts, a stope, and drifts extend from the 12-, 30-, 61-, and 91-m levels. Two inaccessible shafts are east of the main shaft. The flooded one, near locality no. 51, is collared in tactite. The other, at locality no. 52, is caved, but reported to be 24 m deep and entirely in tactite. Outlying surface workings were dug to locate extensions of the tactite. Most exposures in these workings are probably faulted segments of the main deposit.

SAMPLING: Locations of 57 samples taken at the South Peacock mine during the previous study (nos. 1-56) and in 1992 (R7) are shown on fig. A-12 and listed in table A-10. Chip samples from tactite assayed as much as 14 g/t gold (0.41 oz/ton), 120 g/t silver (3.5 oz/ton), and 8 percent copper. Chip samples of granodiorite contained as much as 0.31 percent copper and averaged 0.15 percent.

RESOURCE ESTIMATE: The tactite averages 12 m (40 feet) thick and extends at least 305 m (1,000 ft) along strike. It contains a resource of 1.5 million t (1.7 million short tons) grading 19 g/t (0.56 oz/ton) silver and 1.59 percent copper.

CONCLUSIONS: The faulted tactites to the north and east of the main deposit, as well as surrounding granodiorite, probably contain additional resources.

If the resource at the South Peacock mine was mined, it would probably be mined in conjunction with the resources at the nearby Peacock mine. Based on USBM economic analyses of the mining of a similar-size tactite, of about 2 million t (2.2 million short tons), using small open pit mining and flotation milling, a recoverable mineral value of about $28/t ($31 per short ton) would be required to break even.

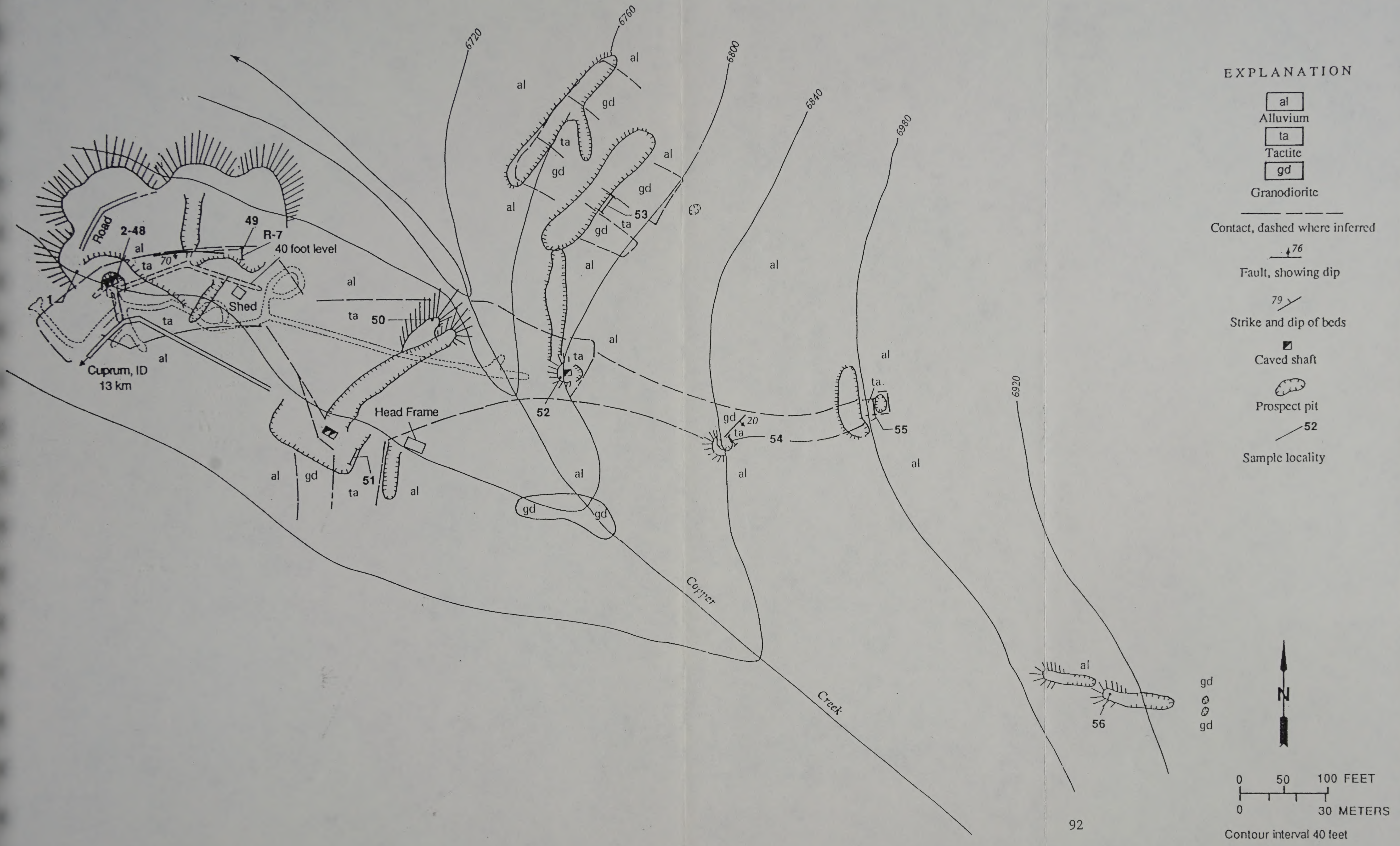

EXPLANATION
al
Alluvium
ta
Tactite
gd
Granodiorite
Contact, dashed where inferred
76
Fault, showing dip
79
Strike and dip of beds
Caved shaft
Prospect pit
52
Sample locality
0 50 100 FEET
0 30 METERS
Contour interval 40 feet
N
6720
6760
6800
6840
6980
6920
Road
2-48
49
R-7
40 foot level
70
Shed
1
Cuprum, ID
13 km
50
51
52
53
54
55
56
Head Frame
20
al
ta
gd
Copper
Creek

Figure A-12.- South Peacock mine

TABLE A-10.--Descriptions and analyses of samples from the South Peacock mine.

[m, meter; g/t, gram per metric ton; NA, not applicable; Tr, trace; sample nos. 1-56 were taken in 1974 and no. R7 in 1992.]

	Sample					
(fig. A-12, no.)	Type	Length (m)	Description	Gold (g/t)	Silver (g/t)	Copper (percent)
1	Grab	NA	Tactite material from 0.4-t stockpile	Tr	82.28	7
2	Chip	1.5	Across granodiorite	0	0	0.12
3	Do..	1.5	Across tactite	Tr	6.86	.05
4	Do..	1.2	Across copper-bearing pod	0	89.14	8.1
5	Do..	3.0	Across tactite	0	13.71	.19
6	Do..	1.2	Across granodiorite	Tr	0	.02
7	Do..	6.1	Across tactite	0.34	20.57	2.3
8	Do..	1.5	Do..	0	Tr	.78
9	Do..	1.5	Do..	.34	17.14	.87
10	Do..	5.2	Do..	.34	27.43	2.1
11	Do..	1.8	Do..	Tr	34.29	.79
12	Do..	1.4	Do..	Tr	3.43	.42
13	Do..	1.8	Do..	Tr	3.43	.44
14	Do..	4.3	Across tactite	0	0	.49
15	Do..	2.1	Down tactite	Tr	6.86	2
16	Do..	1.5	Down granodiorite	Tr	0	.31
17	Do..	1.5	Down tactite	Tr	0	.41
18	Do..	2.1	Do..	Tr	13.71	1.1
19	Do..	4.3	Across tactite	Tr	13.71	1.5
20	Do..	1.8	Down tactite	Tr	3.43	.47
21	Do..	2.1	Do..	Tr	13.71	1.1
22	Do..	2.1	Across granodiorite	Tr	3.43	.13
23	Do..	1.2	Across tactite	0	Tr	.09
24	Do..	3.7	Do..	0	Tr	.03
25	Do..	1.8	Do..	0	0	.09

TABLE A-10.--Descriptions and analyses of samples from the South Peacock mine-continued.

(fig. A-12, no.)	Sample		Description	Gold (g/t)	Silver (g/t)	Copper (percent)
	Type	Length (m)				
26	Chip	4.6	Across tactite	0	0	0.08
27	Do..	1.2	Do..	0	0	.12
28	Do..	7.6	Do..	1.03	10.29	1.7
29	Do..	1.2	Do..	Tr	6.86	.28
30	Do..	4.6	Across shear zone	Tr	20.57	1.6
31	Do..	1.2	Do..	2.74	120.00	6.7
32	Do..	.4	Do..	.34	13.71	8
33	Do..	1.5	Across tactite	Tr	0	1
34	Do..	1.1	Across granodiorite	0	0	2.6
35	Do..	4.0	Across tactite	.34	58.28	5.2
36	Do..	.3	Across shear zone	Tr	13.71	.87
37	Do..	1.3	Across tactite	.34	34.29	.37
38	Do..	9.1	Do..	Tr	6.86	.61
39	Do..	13.1	Across tactite	Tr	48.00	3.7
40	Do..	1.8	Down tactite	0	Tr	0.46
41	Do..	1.2	Across tactite	Tr	51.43	4.6
42	Do..	1.2	Do..	4.06	0	1.6
43	Do..	1.2	Do..	Tr	20.57	2.1
44	Do..	1.4	Do..	0	6.86	.48
45	Do..	1.5	Do..	Tr	20.57	1.5
46	Do..	1.2	Do..	Tr	3.43	.29
47	Do..	1.8	Do..	0	0	.42
48	Do..	1.2	Across granodiorite	0	0	.4
49	Do..	4.3	Across tactite	Tr	3.43	.55
50	Grab	NA	Tactite material from dump	Tr	3.43	1.7
51	Chip	6.1	Across tactite	Tr	68.57	4.2
52	Select	NA	Tactite material from dump	.34	109.71	7.6
53	Chip	7.6	Across tactite	0	0	.01

TABLE A-10.--Descriptions and analyses of samples from the South Peacock mine-continued.

(fig. A-12, no.)	Sample		Description	Gold (g/t)	Silver (g/t)	Copper (percent)
	Type	Length (m)				
54	Chip	3.7	Across tactite	0	0	0.13
55	Do..	4.3	Do..	0	0	0.19
56	Select	NA	Tactite material from dump	Tr	30.86	2.9
R7	Chip	.6	Across tactite	.57	24	4.9

NAME: Tussel adit (copper, silver, gold)

INDEX MAP NO.: Fig. 2, no. 20

LOCATION: NW. 1/4 SW. 1/4 sec. 14, T. 21 N., R. 3 W.; lat 45°08′37"N., long 116°39′55"W.; near the head of Kinney Creek.

ELEVATION: 1,770 m

ACCESS: By road 12 km north from Cuprum.

GEOLOGY OF DEPOSIT: No mineralized structure is exposed; however, the adit trend suggests granitic rocks with a northeast-trending fracture zone. Dump material indicates the fracture contains quartz vein material with malachite, pyrite, and limonite.

WORKINGS: The caved adit probably follows the vein for about 150 m.

SAMPLING: A select sample, of vein material from the dump, had trace gold and 1.2 percent copper.

CONCLUSIONS: The assay suggests a mineral resource potential.

NAME: Tussel mine (copper, silver, gold)

INDEX MAP NO.: Fig. 2, no. 21

LOCATION: SE. 1/4 sec. 14, T. 21 N., R. 3 W.; lat 45°09′16"N., long 116°39′46"W.; at the head of Kinney Creek.

ELEVATION: 1,950 m

ACCESS: By road 11 km north from Cuprum.

PRODUCTION: About 17 t (19 short tons) ore, containing 31 g (1 oz) of gold, 156 g (5 oz) of silver, and 1,248 kg of copper, were shipped in 1937 (Close and others, 1976).

GEOLOGY OF DEPOSIT: The mine is on poorly-exposed tactite zone between granodiorite and limestone containing quartz, bornite, and malachite.

WORKINGS: A caved adit, about 610 m long, and eight dozer trenches are in a 10 ha-area.

SAMPLING: Two samples were taken during the previous study and another seven in 1992 (R8-R14). The descriptions and analyses of the samples taken during the previous study are listed below. Those taken in 1992 are summarized below and listed in detail in appendix C.

A chip sample across the only exposure of the tactite zone, taken in 1974, contained 0.12 percent copper. A sample from a small stockpile of tactite material, also taken in 1974, assayed 12.3 g/t (0.36 oz/ton) gold, 10 g/t (0.3 oz/ton) silver, and 2.7 percent copper. The samples taken during 1992 all contained anomalous amounts of gold, silver, and copper.

CONCLUSIONS: Mineral resources are likely.

NAME: Tussel shaft (copper, silver, gold)

INDEX MAP NO.: Fig. 2, no. 19

LOCATION: NE. 1/4 NE. 1/4 sec. 22, T. 21 N., R. 3 W.; lat 45°08′17"N., long 116°40′59"W.; on Kinney Creek about 4 km east of Hells Canyon Reservoir.

ELEVATION: 1,220 m

ACCESS: By road 12 km north from Cuprum then cross-country 1.6 km.

GEOLOGY OF DEPOSIT: The shaft is in rhyolite that is transected by a 0.6-m-thick quartz lens containing pyrite, bornite, and malachite.

WORKINGS: A 8-m-long shaft (decline) follows the lens which strikes N. 40° E. and dips 45° SE.

SAMPLING: A grab sample, of sulfide-bearing quartz, assayed 7.9 g/t (0.23 oz/ton) gold, 30.9 g/t (0.9 oz/ton) silver, and 1.5 percent copper. A chip sample across the lens had 0.7 g/t (0.02 oz/ton) gold and 0.2 percent copper.

CONCLUSIONS: The lens has some high-grade material, but its exposure is too small to allow resource classification. Mineral resources are likely.

NAME: White Monument mine (copper, silver, gold)

INDEX MAP NO.: Fig. 2, no. 23

LOCATION: Center sec. 24, T. 21 N., R. 3 W.; lat 45°08′36"N., long 116°38′38"W.; on the divide between Kinney and Indian Creeks.

ELEVATION: 2,190 m

ACCESS: By road 10 km north from Cuprum.

HISTORY: The White Monument claim, covering 8.3 ha, was located in 1879 and patented in 1880 (Lot-38).

PRODUCTION: Livingston and Laney (1920, p. 82) reported that in the early 1900′s, 91 t (100 short tons) of ore, containing 30 percent copper and "good" gold and silver values, were shipped.

GEOLOGY OF DEPOSIT: The mine is underlain by intensely-fractured limestone intruded by heavily limonite-stained granodiorite. The granodiorite intrusion resulted in the formation of two discontinuous tactite zones which trend northeast and are copper-bearing. They are along the north and south sides of the limestone. The tactites are composed of malachite- and azurite-coated garnet, quartz, epidote, and hematite, containing pyrite, bornite, covellite, and chalcopyrite.

WORKINGS: Work has been centered on the south tactite zone where there are a 30-m-long adit, possibly with a stope; a less than 15-m-deep caved, decline; and two prospect pits. On the north zone is a shallow prospect pit.

SAMPLING: Twelve 1.5-to-6.7-m-long chip samples were taken from the two tactite zones. They assayed as much as trace gold, 69 g/t (2 oz/ton) silver, and 8.8 percent copper.

CONCLUSIONS: Typical of tactites in the area; exploration at depth would probably disclose resources.

DESCRIPTIONS OF SIGNIFICANT JACKLEY MOUNTAIN MINERALIZED SITES

NAME: Curren Mountain prospect (gold, silver)

INDEX MAP NO.: Fig. 2, no. 47

LOCATION: NE. 1/4 sec. 36, T. 22 N., R. 2 W.; lat 45°12′25"N., long 116°31′08"W.; atop the divide between Paradise and Granite Creeks.

ELEVATION: 2,320 m

ACCESS: By trail (the old Iron Spring wagon road) 3.2 km northeast from the end of the Black Lake road.

GEOLOGY OF DEPOSIT: A vein in diorite, striking due north and dipping vertically, is composed of quartz, pyrite, and pseudomorphs of limonite after pyrite.

WORKINGS: There are four prospect pits and a caved adit about 30 m long.

SAMPLING: Three chip samples from across the vein assayed as much as 1.7 g/t (0.05 oz/ton) gold and 30.9 g/t (0.9 oz/ton) silver.

CONCLUSIONS: The vein is exposed for 270 m along strike and averages 0.2 m thick. It is an occurrence grading 1 g/t (0.03 oz/ton) gold and 10 g/t (0.3 oz/ton) silver--to small and low grade to be classified a resource. However, resources could be at depth.

NAME: Holbrook Saddle prospect (gold, silver, copper)

INDEX MAP NO.: Fig. 2, no. 50

LOCATION: NE. 1/4 sec. 24, T. 22 N., R. 2 W.; lat 45°14′17"N., long 116°30′42"W.; on the divide between Copper and Paradise Creeks.

ELEVATION: 2,300 m

ACCESS: North about 9.6 km by trail and cross country travel from the end of the Black Lake road.

GEOLOGY OF DEPOSIT: The prospect is underlain by metamorphosed volcanic rocks transected by a poorly-exposed shear zone. The zone exposure is 1 m thick, 64 m long, strikes N. 32° E., dips 90°, contains quartz stringers and lenses, and is lightly limonite stained. Pyrite and magnetite are along the contacts between the quartz and wallrock.

WORKINGS: There are five small prospect pits.

SAMPLING: A total of six samples were taken. Two chip samples, across the shear zone, averaged trace gold, 2.3 g/t (0.07 oz/ton) silver, and trace copper. Three grab samples, from stockpiles, had as much as 5.5

g/t (0.16 oz/ton) gold, 24 g/t (0.7 oz/ton) silver, and 0.49 percent copper.

CONCLUSIONS: The limited exposure precludes a resource estimate. However, the analyses of the stockpile samples suggest that gold-, silver-, and copper-bearing resources could be at depth.

NAME: Iron Springs prospect (gold, copper)

INDEX MAP NO.: Fig. 2, no. 48

LOCATION: SW. 1/4 sec. 25, T. 22 N., R. 2 W.; lat 44°51′16"N., long 116°24′21"W.; on upper Paradise Creek.

ELEVATION: 2,070 m.

ACCESS: By trail 6.4 km northerly from the end of the Black Lake road.

HISTORY: About 33 placer and lode mining claims were located in the vicinity of Paradise Springs in the early 1900′s. The settling of the town of Iron Springs followed, and area prospects were acquired by the Iron Springs Mining Company, Ltd. Mine development ceased by 1920 and the workings were allowed to cave. In the 1904 Idaho Mine Inspectors Report, R. N. Bell (p. 137) reported:

> "....The principal ore developments consist of a wide fissure zone in greenstone that is as much as 25 feet wide, filled with a siliceous schisty gangue richly impregnated with gold bearing iron pyrites that has been opened by an adit tunnel 500 feet long. There is also a crosscut tunnel on the property 480 feet long and a fine three compartment shaft 80 feet deep...."

In 1905, Bell (p. 131) reported the shaft had been sunk to 61 m and said that:

> "....The mineral deposits are in a 200-foot-wide, several-thousand-foot-long fissure zone of siliceous schisty formation, heavily impregnated with gold-bearing iron pyrite, in walls of greenstone and diorite. During a two-year period of development, a great many samples have been taken, and I am informed by the management that they indicate an average value of $10 gold per ton throughout the whole width of the zone.

GEOLOGY OF DEPOSIT: The area is forested and overgrown. No mineralized structures are exposed. However, material on dumps suggests at depth is contact zone composed of sheared, limonite stained, pyritic, metavolcanic rock and diorite, containing quartz veins. Stockpiled vein material contains finely disseminated pyrite and arsenopyrite.

WORKINGS: On the prospect is a caved shaft which, judging from the size of the dump, was probably the entrance to more than 305 m of underground

workings. A number of small prospect pits surround the main workings.

SAMPLING: Five samples from stockpiles and dumps contained trace amounts of silver and copper.

CONCLUSIONS: A mineral resources could be at depth in this large, poorly-exposed zone.

NAME: Jackley Ridge prospect (copper, silver, gold)

INDEX MAP NO.: Fig. 2, no. 52

LOCATION: SW. 1/4 SE. 1/4 sec. 12, T. 22 N., R. 2 W.; lat 44°51′54"N., long 116°25′19"W.; on the divide between West Fork Rapid River and Copper Creek.

ELEVATION: 2,500 m

ACCESS: By trail and cross-country 9.6 km north from the Black Lake road.

GEOLOGY OF DEPOSIT: No mineralized structure is exposed, but dump material and alignment of workings are suggestive of metavolcanic rocks transected by northwest-trending mineralized fractures. The fractures are evidently filled by quartz, limonite- and manganese-stained, and containing pyrite and magnetite.

WORKINGS: There three prospect pits.

SAMPLING: Three grab samples of quartz and fractured material from the dumps assayed as much as trace gold, 6.9 g/t (0.2 oz/ton) silver, and 0.75 percent copper.

CONCLUSIONS: Lack of exposures precludes an estimate; however, mineral resources may exist.

NAME: Maid of Erin mine (gold, silver)

INDEX MAP NO.: Fig. 2, no. 43

LOCATION: SW. 1/4 NW. 1/4 sec. 2, T. 21 N., R. 2 W.; lat 45°11′21"N., long 116°33′09"W.; 0.4 km east of Black Lake.

ELEVATION: 2,150 to 2,260 m

ACCESS: North by the Black Lake road about 18 km north from Bear, then southeast cross country about 0.4 km.

HISTORY: The mine consisted of one millsite and five lode claims covering about 41 ha (MS-1677). They were located in 1895 and 1900, and

patented in 1908. The Maid of Erin and the Summit mine were developed from 1901 until 1915 by the Salyer-Ford Mining Company followed by the Idaho Gold Coin Mining Company. These companies built and operated a 45 t/d cyanide mill below Black Lake (fig. 2, no. 44). The ore was transported from the Maid of Erin mine to the mill by tram and wagon.

Livingston and Laney (1920, p. 36) reported the Maid of Erin mine to be on a gold-bearing quartz vein with gold concentrations in the sulfide-bearing portions. Nearly all ore came from a sulfide lens 0.4 m thick, 12 m long, and 69 m deep. The lens averaged $6.61/t in gold at a price of $0.66/g ($20 per troy ounce). This represents a gold content of at least 9.9 g/t (0.29 oz/ton). The mine was abandoned in 1915 and then reopened in 1937 when ore was trucked 12 km south to the Placer Basin mill for processing (fig. 2). The Maid of Erin was shut down soon after; the patented claims were reconveyed to the United States Government in the 1960's. Remoteness, long winters, and resulting high operating costs, accompanied by unsatisfactory mill recovery, caused mining operations to be unprofitable.

PRODUCTION: Recorded production, between 1901 and 1915, was included with that recorded from the Summit mine.

GEOLOGY OF DEPOSIT: A quartz vein, as thick as 1.2 m, strikes N. 25° W., and dips 55° NE. to 50° SW (fig. A-13). The vein is in a roof pendant of jointed, fractured, metamorphosed volcanic beds which strike N. 20° W. and dip 45° SW. The vein terminates against engulfing diorite and is composed of white, limonite-stained quartz and pyrite. Sulfides occur as disseminations throughout the quartz, and along vein contacts as lenses which are as thick as 0.4 m.

WORKINGS: There are two caved adits, with stopes that are open to the surface, all estimated to be about 305 m long.

SAMPLING: The locations of the eight samples taken during the previous study, along with the locations of three samples taken in 1992, are shown on figure A-13; analytical results are on table A-11. Additional data for the samples (R16-R18) taken in 1992 are listed in appendix C. Five chip samples taken across the vein assayed as much as 29 g/t (0.85 oz/ton) gold and 10 g/t (0.3 oz/ton) silver.

RESOURCE ESTIMATE: The vein, averaging 0.9 m (3 feet) thick, probably extends along strike for at least 430 m (1,400 feet). It contains a resource of at least 220,000 t (240,000 short tons) grading 4.1 g/t (0.12 oz/ton) gold and 3.4 g/t (0.1 oz/ton) silver.

CONCLUSIONS: If the resource at the Maid of Erin mine were to be mined it would probably be mined in conjunction with the resources at the nearby Summit mine. Based on USBM economic analysis of mining similar vein-type resources of about 300,000 t (330,000 short tons) using vertical crater retreat mining and carbon in leach milling, production could break even at a recoverable mineral value of about $79/t ($87 per short ton).

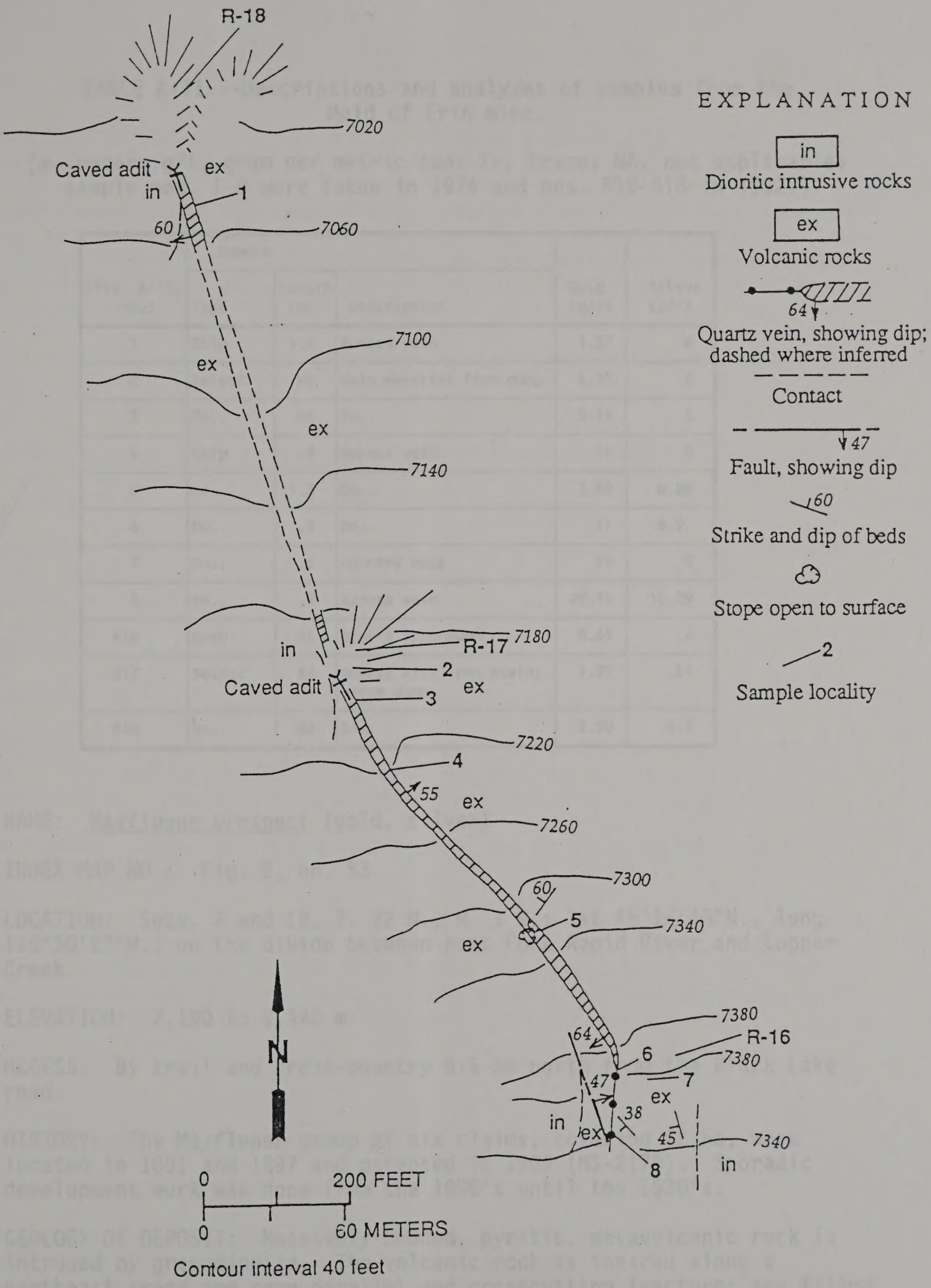

R-18
7020
Caved adit
in
ex
1
60
7060
7100
ex
ex
7140
in
R-17
7180
2
Caved adit
ex
3
7220
4
55
ex
7260
7300
60
5
7340
ex
N
7380
R-16
64
6
7380
47
7
ex
38
in
ex
45
7340
in
8
0
200 FEET
0
60 METERS
Contour interval 40 feet
EXPLANATION
in
Dioritic intrusive rocks
ex
Volcanic rocks
64
Quartz vein, showing dip; dashed where inferred
Contact
47
Fault, showing dip
60
Strike and dip of beds
Stope open to surface
2
Sample locality

Figure A-13.- Maid of Erin mine

TABLE A-11.--Descriptions and analyses of samples from the Maid of Erin mine.

[m, meter; g/t, gram per metric ton; Tr, trace; NA, not applicable; sample nos. 1-8 were taken in 1974 and nos. R16-R18 in 1992.]

Sample (fig. A-13, no.)	Type	Length (m)	Description	Gold (g/t)	Silver (g/t)
1	Chip	1.4	Across vein	1.37	0
2	Select	NA	Vein material from dump	4.11	0
3	Do..	NA	Do..	5.14	0
4	Chip	.9	Across vein	Tr	0
5	Do..	1.3	Do..	3.09	6.86
6	Do..	.5	Do..	Tr	6.9
7	Do..	.6	Country rock	Tr	0
8	Do..	.5	Across vein	29.14	10.29
R16	Grab	NA	Quartz from dump	8.61	.4
R17	Select	NA	Quartz with iron stain; from dump	1.97	.01
R18	Do..	NA	Do..	2.90	6.7

NAME: Mayflower prospect (gold, silver)

INDEX MAP NO.: Fig. 2, no. 53

LOCATION: Secs. 7 and 18, T. 22 N., R. 1 W.; lat 45°14′48"N., long 116°30′27"W.; on the divide between West Fork Rapid River and Copper Creek.

ELEVATION: 2,190 to 2,440 m

ACCESS: By trail and cross-country 9.6 km north from the Black Lake road.

HISTORY: The Mayflower group of six claims, covering 52 ha, were located in 1891 and 1897 and patented in 1909 (MS-2179). Sporadic development work was done from the 1890′s until the 1930′s.

GEOLOGY OF DEPOSIT: Massively-bedded, pyritic, metavolcanic rock is intruded by granodiorite. The volcanic rock is sheared along a northeast trend and some parallel and crosscutting fractures are filled by pyritic rhyolite dikes and quartz veins. Limonite-stained with scattered pyrite disseminations, the veins are as thick as 6 m thick.

They usually strike N. 10° to 20° E. and dip less than 55°.

WORKINGS: Scattered over an area of about 2 km^2 are 15 prospect pits and 10 caved adits with an estimated total length of 910 m.

SAMPLING: Thirty-six samples were; chipped from the few vein outcrops and country rock, or grabbed from mine dumps and small stockpiles. One sample, from a 0.4 t stockpile of quartz vein material, contained 25.7 g/t (0.75 oz/ton) gold and 75.4 g/t (2.2 oz/ton) silver. The others assayed only trace gold and silver.

CONCLUSIONS: The zone of shearing is strong and persistent. Material at one stockpile indicates resources may be at depth.

NAME: Middle Mountain prospect (gold, silver, copper)

INDEX MAP NO.: Fig. 2, no. 49

LOCATION: NW. 1/4 NW. 1/4 sec. 24, T. 22 N., R. 2 W.; lat 45°13′58"N., long 116°32′00"W.; on the divide between West Fork Rapid River and Paradise Creek.

ELEVATION: 2,440 to 2,500 m

ACCESS: By trail 11 km north from the Black Lake road.

GEOLOGY OF DEPOSIT: A quartz vein, striking N. 80° W. and dipping 85° NE., is limonite coated, is as thick as 6-m, and is in pyritic greenstone. The vein is exposed intermittently along strike for 24 m.

WORKINGS: There are two prospect pits, and three caved adits with an estimated total length of 210 m.

SAMPLING: Three samples were chipped from the vein; another three were grabbed from small stockpiles and mine dumps. Only two samples, one vein and one stockpile, had significant metals contents--a vein chip sample contained 0.7 g/t (0.02 oz/ton) gold, and a stockpile sample assayed 24 g/t (0.7 oz/ton) silver and 0.075 percent copper.

CONCLUSIONS: A mineral resource potential is indicated.

NAME: Summit mine (gold, silver)

INDEX MAP NO.: Fig. 2, no. 42

LOCATION: Sec. 3, T. 21 N., R. 2 W.; lat 45°11′05"N., long 116°33′56"W.; in the cirque west of Black Lake.

ELEVATION: 2,290 to 2,440 m

ACCESS: North by road about 18 km from Bear then west about 0.4 km by forest trail.

HISTORY: The mine consists of a millsite and five lode claims, located between 1897 and 1900 and patented in 1914 (MS-1678). Covering about 42 ha, the claims were developed along with the Maid of Erin mine (fig 2, no 43), from 1909 until 1915, and in 1937. The mines were operated by Salyer-Ford Mining Company, and later the Idaho Gold Coin Mining Company. Ore from the Summit mine was transported by tram and wagon to a cyanide mill below Black Lake (fig. 2, no. 44) and in 1937 by truck to a mill at Placer Basin. All of the patented claims were reconveyed to the U.S. Government in the 1960's.

PRODUCTION: Between 1902 and 1916, 12,735 t (14,037 short tons) of ore containing 220,175 g (7,079 oz) of gold and 45,753 g (1,471 oz) of silver were produced from the Summit and Maid of Erin mines. In 1937, another 378 t (417 short tons) of ore containing 3,639 g (117 oz) of gold and 622 g (20 oz) of silver were produced (Close and others, 1976). All of the ore graded 17.1 g/t (0.5 oz/t) gold and 3.5 g/t (0.1 oz/t) silver; worth $12/t ($13 per short ton) at historic prices.

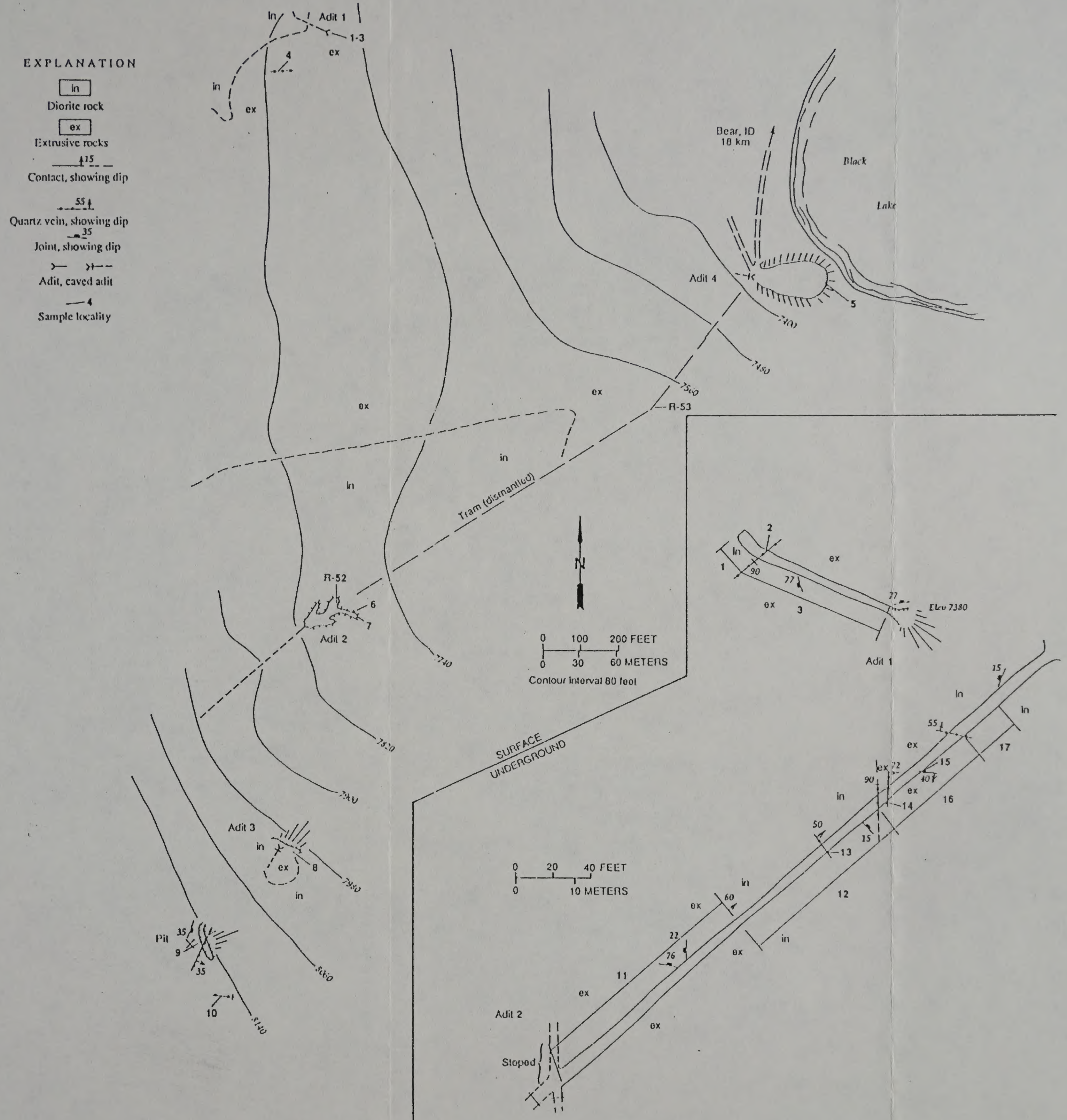
GEOLOGY OF DEPOSIT: The mineralized structure mined is not exposed; only a few small parallel veins. Livingston and Laney (1920, p. 36) reported that mined was a 305-m-long quartz vein striking N. 15° E. and dipping 70° SE. This vein averaged $10.89/t ($9.85/ton) in gold at a price of $0.67/g ($20/oz). It and smaller veins are along an irregular, northeast-trending fracture-zone transecting massively bedded metavolcanic- and dioritic-rocks.

WORKINGS: At the Summit mine there are four adits (fig. 14, nos. 1-3) estimated to total 610 m; 490 m of which including, all workings along the principal vein, are caved. A tram, now dismantled, was used to transport the ore from Adit 2 to a wagon road (at adit 4) on Black Lake. The ore was then transported by wagon to the mill, also dismantled.

SAMPLING: Seventeen samples (nos. 1-17) were taken during the previous USBM study and two (R52 and R53) during 1992 (fig. A-14). All are listed in table A-12. A sample (R53) of vein material spilled from the tram had 9.9 g/t (0.29 oz/ton) gold. A chip sample (no. 9), across what may be an outcrop of the principal vein, assayed 29.5 g/t (0.86 oz/ton) gold.

RESOURCE ESTIMATE: The overall gold content may be the same as the vein at the Maid of Erin mine--4.1 g/t (0.12 oz/ton) gold. Based on dimensions reported by Livingston and Laney (1920)--0.6 m (2 feet) wide and 305 m (1,000 feet) long, the Summit vein can be inferred to contain a resource of 74,000 t (82,000 short tons).

CONCLUSIONS: If the resource at the Summit mine was to be mined it would probably be mined in conjunction with the resources at the nearby Maid of Erin mine.


EXPLANATION
in
Diorite rock
ex
Extrusive rocks
15
Contact, showing dip
55
Quartz vein, showing dip
35
Joint, showing dip
Adit, caved adit
4
Sample locality
Adit 1
1-3
4
Adit 2
R-52
6
7
Adit 3
8
Pit
9
10
Adit 4
5
R-53
Tram (dismantled)
Bear, ID
18 km
Black
Lake
7400
7480
7560
7320
7240
7160
5000
5140
N
0 100 200 FEET
0 30 60 METERS
Contour interval 80 feet
SURFACE
UNDERGROUND
0 20 40 FEET
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Stoped
11
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Figure A-14.- Summit mine

TABLE A-12.--Descriptions and analyses of samples from the Summit mine.

[m, meter; g/t, gram per metric ton; Tr, trace; NA, not applicable; Do.., same as above; sample nos. 1-17 taken in 1974, and nos. R52 and R53 in 1992.]

	Sample					
(fig. A-14, no.)	Type	Length (m)	Description	Gold (g/t)	Silver (g/t)	Copper (percent)
1	Chip	4.6	Along adit wall, intrusive rock	0.2	0	Tr
2	Do..	.2	Across vein	.2	3	Tr
3	Do..	22.9	Along adit wall, volcanic rock	0	3	Tr
4	Do..	.03	Across vein outcrop	0	0	Tr
5	Grab	NA	Dump material	.2	0	0
6	Do..	NA	Do..	0	7	0
7	Select	NA	From dump, vein material	8.2	0	Tr
8	Do..	NA	Do..	6.2	0	Tr
9	Chip	.6	Across vein	29.5	3	Tr
10	Do..	.5	Do..	.2	0	0
11	Do..	37.2	Do..	.7	0	0
12	Do..	28.7	Along adit wall, intrusive rock	0	7	0
13	Do..	1.2	Across vein	2.4	7	0
14	Do..	.3	Do..	0	0	0
15	Do..	.3	Do..	0	0	0
16	Do..	17.7	Along adit wall, volcanic rock	.2	0	0
17	Do..	7.3	Along adit wall, intrusive rock	.2	0	Tr
R52	Grab	NA	From dump, vein material	2.4	2	0.02
R53	Do..	NA	Vein material spilled from tram	9.6	1	0.008

NAME: White Rose prospect (gold, silver, copper)

INDEX MAP NO.: Fig. 2, no. 51

LOCATION: SW. 1/4 sec. 18, T. 22 N., R. 1 W.; lat 45°14′25"N., long 116°30′30"W.; at the head of Copper Creek.

ELEVATION: 2,070 m

ACCESS: By trail 8.8 km north from Black Lake road.

GEOLOGY OF DEPOSIT: No mineralized structure is exposed. Dump material and alignment of workings suggest phyllitic greenstone contains northeast-trending, limonite- and pyrite-bearing quartz veins.

WORKINGS AND FACILITIES: There are three caved adits estimated to total more than 305 m. No quartz vein material is exposed in place, but pyrite-bearing quartz is on the dumps. A small tailings pile indicates some material was crushed and concentrated in a sluice box. A boiler and pump above the main adit suggest that the workings are wet and had to be pumped.

SAMPLING: Three grab samples, of quartz from adit dumps, assayed as much as 0.3 g/t (0.01 oz/ton) gold, 17 g/t (0.5 oz/ton) silver, and 0.008 percent copper. A sample from a 0.4-t stockpile had 3.8 g/t (0.11 oz/ton) gold, 17.2 g/t (0.5 oz/ton) silver, and 0.29 percent copper.

CONCLUSIONS: The prospect is indicated to be typical of Jackley Mountain vein deposits; resources could be at depth.

APPENDIX B.--Summary descriptions of miscellaneous mineralized sites within and adjacent to the Rapid River study area.

Following in alphabetical order, by locale, are summary descriptions of 19 miscellaneous sites examined in the Rapid River study sites. The 19 are sites with rock exposures too poor to allow estimation of mineral resources, or sites which yielded samples representing economically insignificant metal content.

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APPENDIX B.--Summary descriptions of miscellaneous mineralized sites within and adjacent to the Rapid River study area.

[Sites shown on figure 2 and listed in tables 1 and 2.]

(fig. 2, no.)	Name/ location	Summary	Workings	Sample data
Windy Ridge sites				
25	California prospect (copper, gold, silver) T.21 N., R.2 W. NW. 1/4 NE. 1/4 sec. 19	Two small tactites are between limestone and granodiorite. The tactites are limestone xenoliths, totaling about 31 m in length, that have been replaced by garnet, quartz, epidote, limonite, malachite, chalcopyrite, bornite, and pyrite.	Nine prospect pits and a north-trending, caved adit, about 31 m long.	Three samples were taken. Two were chip samples across the xenoliths. A 1.8-m-long chip sample assayed 1.9 percent copper; a 4.6-m-long chip sample assayed trace gold, 41 g/t (1.2 oz/ton) silver, and 0.06 percent copper. A select sample, of tactite, contained 6.9 g/t (0.2 oz/ton) gold, 0.3 g/t (0.008 oz/ton) silver, and 7 percent copper.
26	Chieftain prospect (copper, silver and gold) T.21 N., R.2 W. center sec. 18	No mineralized structure is exposed; however, dump material suggests a tactite between granodiorite and limestone. Dump material is composed of malachite-stained garnet, epidote, and hematite, with bornite, chalcopyrite, pyrite, and molybdenite.	Four small prospect pits, a 18-m-long adit in barren granodiorite, and three caved adits, about 610 m total.	Eight grab samples, of dump material, were taken. The best assayed 1 g/t (0.03 oz/ton) gold, 2 g/t (0.06 oz/ton) silver, 2.6 percent copper, and 0.07 percent molybdenum. The rest assayed trace gold, silver, and copper.
16	East Allison Gulch prospect (copper, gold, silver) T.21 N., R.3 E. SE. 1/4 NE. 1/4 sec. 27	Northeast-trending, northwest-dipping andesite beds contain a conformable, 6-m-thick zone of volcanogenic quartz stringers.	A 6-m-deep shaft.	One chip sample across the quartz stringers had insignificant metal content.

APPENDIX B.--Summary descriptions of miscellaneous mineralized sites within and adjacent to the Rapid River study area-continued.

(fig. 2, no.)	Name/ location	Summary	Workings	Sample data
Windy Ridge sites-continued				
24	Emily prospect (copper, silver, gold) T.21 N., R.3 W. E. 1/2 sec. 24	No mineralized structure is exposed. The dumps contain limestone and granodiorite and tactite consisting of garnet, epidote, hematite, malachite, and pyrite.	Six small prospect pits, and three caved adits with a total length probably less than 230 m.	Three grab samples were taken from the dumps. They had from trace to 0.7 g/t (0.02 oz/ton) gold, 3.4 to 69 g/t (0.1 to 2 oz/ton) silver, and 0.04 to 2.1 percent copper.
30	Ritchie Gulch adit (silver) T.21 N., R.2 W. NW. 1/4 NW. 1/4 sec. 18	A 0.3-m-thick, N. 10° E. striking, 35° SE. dipping, limonite-stained quartz fissure-vein is in diorite.	An adit follows the vein for 6 m.	A chip sample across the vein assayed trace gold, 3.4 g/t (0.1 oz/ton) silver, 0.006 percent copper, and 0.01 percent lead.
1	Terry prospect (copper, gold, silver) T.20 N., R.4 W. SE. 1/4 sec. 26	In limonite-stained, fractured volcanic beds, striking N. 10° to 20° E. and dipping 15° to 25° NW, is a volcanogenic quartz vein striking N. 30° W. and dipping 90°. The vein exposure is malachite-stained, as thick as 0.5 m and 60 m long.	Two prospect cuts.	Two chip samples across the vein assayed nil and 0.08 percent copper, respectively.
28	Victory tungsten mine T.22 N., R.2 W. SW. 1/4 sec. 9	The mine is underlain by a 12-m-wide, 46-m-long, limestone roof pendant in granodioritic rocks. Near the contacts, the limestone has been sheared, garnetized, silicified, and mineralized.	About 3.6 t of ore, that yielded 82 kg of tungsten trioxide, were mined in 1942 (Close and others, 1976). The ore was mined from the surface along hundreds of meters of dozer trenches and pits.	Four chip samples from the pendant and pendant-granite contacts, contained as much as 0.28 percent copper and 0.09 percent WO_3. The high grade portion of the deposit is depleted.
27	Virginus prospect (gold, silver) T.21 N., R.2 W. SE. 1/4 sec. 18	Limestone surrounded by granodiorite has been partially replaced by malachite-coated garnet, epidote, and hematite along the generally northeast-trending contact zone. The 6-m-wide zone is exposed to a depth of 4.5 m; workings indicate it to be 90 m long.	The Virginus claim, located in 1907 and patented in 1910 (MS-2428), covers about (8 h). There are two prospect pits.	One chip sample, across the only exposure of the zone, assayed trace gold, 0.006 percent copper, and 0.1 percent lead.

APPENDIX B.--Summary descriptions of miscellaneous mineralized sites within and adjacent to the Rapid River study area-continued.

(fig. 2, no.)	Name/ location	Summary	Workings	Sample data
Windy Ridge sites-continued				
2	Windy prospect (copper, gold, silver) T.20 N., R.3 W. SE. 1/4 sec. 34	No mineralized structure is exposed, only red scoria.	Stone claim monument.	A chip sample (appendix C, R19) of the scoria assayed 125 ppb gold.
Jackley Mountain sites				
46	Pactolian Gulch prospect (copper, gold, silver) T.22 N., R.2 W. NE. 1/4 sec. 35	No mineralized structure is exposed. Workings and dump material suggest a shear zone, in metavolcanic- and intrusive-rocks, striking N. 35° E. and dipping 90°. Stained by limonite and manganese-oxide, the zone contains quartz veins and stringers as thick as 0.6 m. Pyrite is in the veins and adjacent rock.	Bell (1904, p. 137) reported that Pactolian Mining Company owned a section of the fissure zone along which the Iron Springs prospect was located, and that the company had done considerable underground work. The Pactolian prospect was acquired by Iron Springs Mining Company, Ltd., in 1904. One caved adit, about 150 m long, was found during the USBM investigation.	Three grab samples of pyrite-bearing dump material assayed trace gold and silver and 0.005 percent copper.
41	Rock Lake prospect (gold) T.21 N., R.2 W. NE. 1/4 NW. 1/4 sec. 10	A pyrite-bearing quartz vein, in an andesite roof pendant, is surrounded by intrusive rock. The 0.9-m-thick vein exposure strikes N. 55° E. and dips 80° SE. It terminates at the andesite-intrusive rock contact.	One prospect pit.	A sample across the vein had no significant mineral content.
45	Satan Lake prospect (gold, silver, copper) T.22 N., R.2 W. NW 1/4 sec. 35	Quartz is along a shear zone in metavolcanic and dioritic rocks. The zone strikes N. 35° E., dips vertically, and is more than 150 m wide. It extends more than 3.2 km from Black Lake northeast to Iron Springs. Volcanic rocks and quartz along the zone contain pyrite.	Four adits, the longest 61 m.	Four chip samples across the shear zone, including pyrite bearing quartz, had traces of gold and silver, and less than 0.02 percent copper.

APPENDIX B.--Summary descriptions of miscellaneous mineralized sites within and adjacent to the Rapid River study area-continued.

(fig. 2, no.)	Name/ location	Summary	Workings	Sample data
Isolated sites				
57	Black Leopard prospect (gold, silver) T.22 N., R.1 W. SW. 1/4 sec. 27	Impure, silicified, limonite-stained marble beds strike N. 10° W. and dip 35° SW. No economic minerals were observed. In the marble are bands of green serpentine that resemble copper minerals.	Three prospect pits.	Two samples, one from the pit dumps and the other of country rock, each contained trace amounts of gold and silver.
55	Indian Springs prospect (gold) T.21 N., R.1 W. NW. 1/4 NW. 1/4 sec. 21	Finely bedded marble and slate are transected by intrusive rocks. The metasedimentary rocks contain three, massive, pyrite-bearing quartz lenses less than 0.3-m-thick.	Three small prospect pits.	Three chip samples of quartz and wallrock had no significant metal content.
56	North Star Butte prospect (gold) T.21 N., R.1 W. SE. 1/4 sec. 16	Garnet schist, with foliation striking N. 35° W. and dipping northeast, contains quartz lenses less than 0.3 m thick that generally trend west and dip north.	Three prospect pits.	Three chip samples across the principal quartz lenses had no significant metal content.
59	Paradise Cabin prospect (gold) T.22 N., R.1 W. SW. 1/4 sec. 22	In andesite is a N. 40° E. striking, 15° NW. dipping, 1.1-m-thick, quartz bearing shear zone. Sparse pyrite occurs along the contact between the quartz and andesite.	One shaft 4.5 m deep.	One chip sample taken in the shaft, across the shear zone, assayed trace gold.
58	Trail Creek prospect (copper, gold) T.22 N., R.1 W. SE. 1/4 sec. 22	A northwest-trending, southwest-dipping quartz pod is in granitic rock. The pod is 0.9 m thick and 1.2 m long.	One prospect pit.	A chip sample across the pod had trace gold and 0.6 percent copper.

APPENDIX B.--Summary descriptions of miscellaneous mineralized sites within and adjacent to the Rapid River study area-continued.

(fig. 2, no.)	Name/ location	Summary	Workings	Sample data
Isolated sites-continued				
54	Twin Lakes prospect (gold) T.21 N., R.20 W. NE. 1/4 sec. 24	In andesite is a northeast-trending zone of shearing. Fractures along the zone are filled with limonite-stained, pyrite-bearing quartz lenses. Three lenses, cropping out for less than 30 m, are as thick as 2.3 m; they strike N. 35° to 75° E. and dip from 30° NW. to 75° SE.	In a 1,070 by 460 m area are six prospect pits and a caved adit estimated to be less than 30 m long.	One of five chip samples across quartz lenses had 0.7 g/t (0.02 oz/ton) gold. The remainder were insignificant.

APPENDIX C.--Descriptions and chemical analyses of rock samples taken from the Rapid River study area in 1992.

[Samples from mineralized sites shown on figure 2; Au, gold; Ag, silver; As, arsenic; Bi, bismuth; Cu, copper; Hg, mercury; Mn, manganese; Mo, molybdenum; Pb, lead; Sb, antimony; W, tungsten, and; Zn, zinc; NA, not applicable; Do.., same as above; ppb, parts per billion; ppm, parts per million; %, percent; <, less than; oz/ton, troy ounce per ton; m, meter.]

(fig. 2, no.)	Site name	Sample				Au (ppb)	Au (oz/ton)	Ag (ppm)	Ag (oz/ton)	As (ppm)	Bi (ppm)	Cu (ppm)	Hg (ppb)	Mn (ppm)	Mo (ppm)	Pb (ppm)	Sb (ppm)	W (ppm)	Zn (ppm)
		No.	Type	Length (m)	Description														
2	Windy prospect	R19	Chip	30	Across red scoria	125	0.004	0.5	0.02	<5	<5	126	20	503	1	4	<5	<10	55
3	Azurite mine	R56	Grab	NA	From dump, vein material	170	0.005	340	10.93	280	<5	4925	35200	362	35	530	1625	1500	5.1%
		R57	Do..	NA	Do..	105	0.003	22	0.71	62	<5	885	37100	201	5	86	197	150	8135
		R58	Do..	NA	Do..	50	0.002	20	0.64	136	<5	1070	27450	1410	20	245	215	405	2.1%
5	River Queen mine	R21	Grab	NA	Massive sulfides	80	0.003	5.4	0.17	6	<5	4.7%	210	1810	10	22	<5	<10	5
6	Crackerjack mine	R20	Grab	NA	From dump, quartz with limonite after pyrite	350	0.010	1.0	0.03	10	<5	182	550	525	2	32	45	<10	170
		R55	Do..	NA	From dump, vein material	755	0.022	90	2.89	54	<5	132	69750	685	4	135	450	<10	305
7	Nix prospect	R22	Chip	0.2	Across shear zone	25	0.001	<0.2	0	6	<5	230	30	1320	2	5	<5	<10	158
15	Lyles Saddle prospect	R15	Chip	.4	Across limonitic volcanic rock	5	0	<0.2	0	<5	<5	216	60	1165	4	<2	<5	<10	129
		R50	Grab	NA	Silicified andesite; limonitic along fractures	<5	0	<0.2	0	<5	<5	82	<10	602	<1	4	<5	<10	65
		R51	Do..	NA	Drusy quartz with pyrite, bornite, and malachite	50	0.002	146	4.69	320	<5	8210	45125	460	6	282	3050	<10	1015

APPENDIX C.--Descriptions and chemical analyses of rock samples taken from the Rapid River study area in 1992-continued.

(fig. 2, no.)	Site name	Sample No.	Type	Length (m)	Description	Au (ppb)	Au (oz/ton)	Ag (ppm)	Ag (oz/ton)	As (ppm)	Bi (ppm)	Cu (ppm)	Hg (ppb)	Mn (ppm)	Mo (ppm)	Pb (ppm)	Sb (ppm)	W (ppm)	Zn (ppm)
21	Tussel mine	R8	Chip	0.2	Across copper-bearing quartz	200	0.006	6.5	0.21	<5	95	2.7%	225	235	215	3	<5	<10	18
		R9	Grab	NA	Iron stained quartz and granitic rock	38	0.001	<0.2	0	<5	6	385	40	412	2	<2	<5	<10	21
		R10	Do..	NA	Iron stained granitic rock	15	0	<0.2	0	<5	<5	150	10	448	1	<2	<5	<10	21
		R11	Do..	NA	Iron and copper stained quartz and granitic rock	62	0.002	0.7	0.02	<5	<5	8725	25	520	45	13	<5	<10	59
		R12	Do..	NA	Do..	335	0.010	12	0.39	<5	172	1.6%	465	282	53	<2	<5	<10	10
		R13	Do..	NA	Iron- and chalcopyrite-bearing quartz and granitic rock	720	0.021	7.4	0.24	<5	190	2.4%	350	380	155	9	<5	<10	14
		R14	Do..	NA	Iron and copper stained quartz and granitic rock	157	0.005	5.8	0.19	5	310	2.7%	480	121	118	12	<5	<10	9
35	South Peacock mine	R7	Chip	0.6	Across bornite-bearing tactite	570	0.017	24	0.77	7	96	4.9%	265	3350	105	<2	<5	65	44
36	Peacock mine	R5	Chip	18.2	Across tactite	545	0.016	75	2.41	<5	245	6.6%	285	3680	50	<2	<5	80	61
		R6	Do..	18.2	Do..	330	0.010	32	1.03	<5	312	6.9%	540	2200	120	<2	<5	<10	64
37	Haily Ridge prospect	R1	Select	NA	From adit dump; greenstone	7	0	1.0	0.03	<5	<5	197	20	422	2	10	<5	<10	68
		R2	Do..	NA	Quartz, epidote, and bornite tactite material	15	0	<0.2	0	<5	<5	148	<10	935	<1	7	<5	<10	137
		R3	Chip	.4	Across quartz, epidote, and bornite tactite material	10	0	<0.2	0	<5	<5	230	<10	705	1	<2	<5	<10	108

APPENDIX C.--Descriptions and chemical analyses of rock samples taken from the Rapid River study area in 1992-continued.

(fig. 2, no.)	Site name	Sample No.	Type	Length (m)	Description	Au (ppb)	Au (oz/ton)	Ag (ppm)	Ag (oz/ton)	As (ppm)	Bi (ppm)	Cu (ppm)	Hg (ppb)	Mn (ppm)	Mo (ppm)	Pb (ppm)	Sb (ppm)	W (ppm)	Zn (ppm)
37	Haily Ridge prospect	R4	Grab	NA	Quartz, chalcopyrite, and epidote tactite material	3520	0.103	12	0.39	<5	<5	1.0%	35	845	1	<2	<5	50	176
42	Summit mine	R52	Grab	NA	Quartz vein material from dump	2365	0.069	2.3	0.07	10	7	204	735	67	8	3	16	<10	37
		R53	Do..	NA	Quartz vein material from tram	9625	0.281	0.6	0.02	17	14	79	220	140	5	3	<5	<10	24
43	Maid of Erin mine	R16	Grab	NA	Quartz with bornite	8610	0.251	0.4	0.01	19	<5	345	35	138	8	<2	<5	<10	62
		R17	Select	NA	Quartz with iron stain	1975	0.058	0.2	0.01	15	<5	122	10	70	5	2	<5	<10	10
		R18	Do..	NA	Do..	2905	0.085	6.7	0.22	12	<5	143	25	805	2	<2	<5	<10	14

APPENDIX D.--Analyses of limestone samples from the Rapid River study area.

[Analyses reported in percent; --, not determined; CaCO = $CaCO_3$; MgCO = $MgCO_3$; SiO = SiO_2; RO = Fe, Fe_2O_3, and Al_2O_3; SO = SO_4; PO = P_2O_5; and KO = K_2O.]

Deposit	CaCO	MgCO	SiO	RO	S	SO	PO	KO	Total
Rapid River	97.7	0.4	0.2	0.39	0.35	0.045	0.0025	0.018	99.11
	94.2	.7	4.1	.86	.019	.057	.0057	.043	99.98
Snake River	95.9	.5	2.2	1.0	.027	.049	.0061	.062	99.74
	96.8	.8	.86	.65	.117	.066	.004	.13	99.43
	78.3	14.8	5.5	1.3	--	--	--	--	99.9 1/
	94.1	3.2	1.3	1.1	--	--	--	--	99.7 1/
	98.0	.7	.55	.2	.011	.033	.0079	.29	99.79

1/ Taken by Savage, 1954; the remainder were taken by the USBM in 1974-1976.